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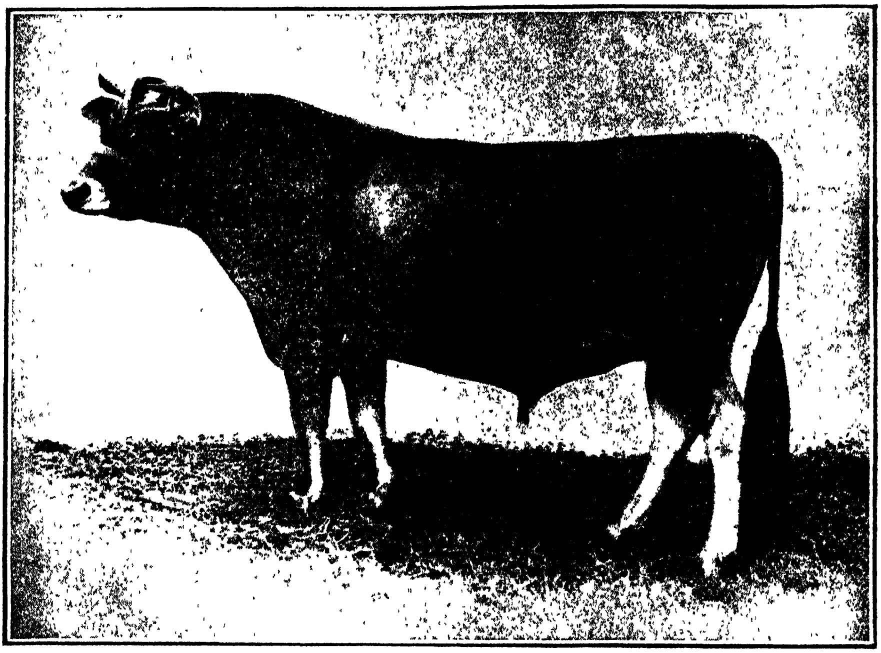

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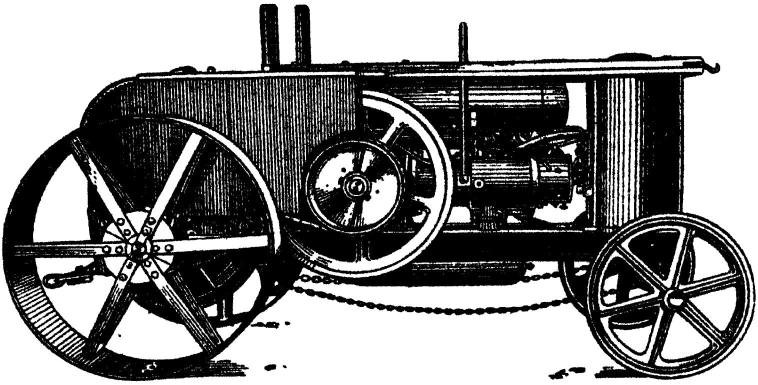

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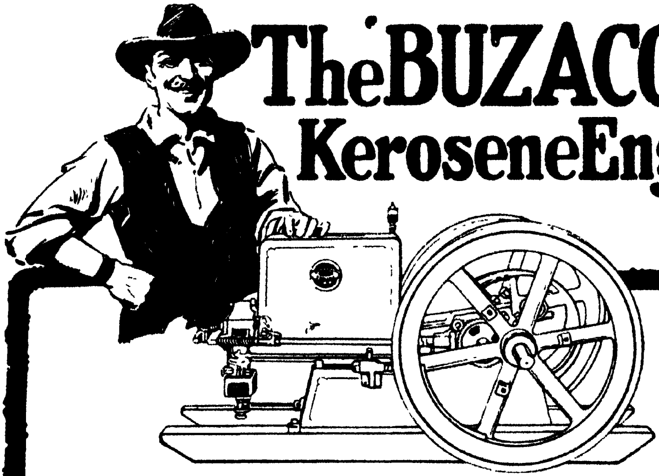

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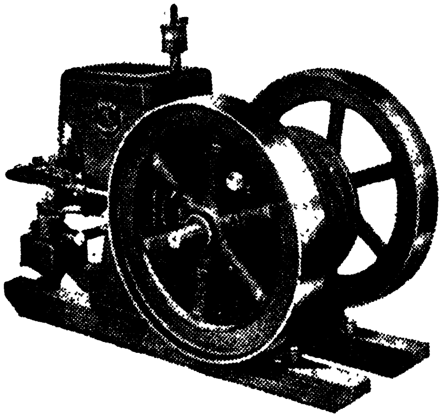

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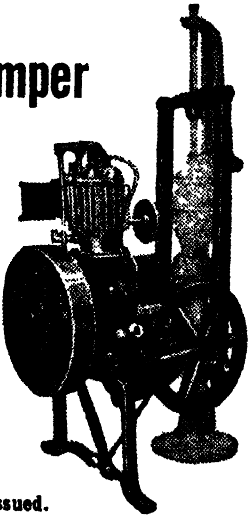

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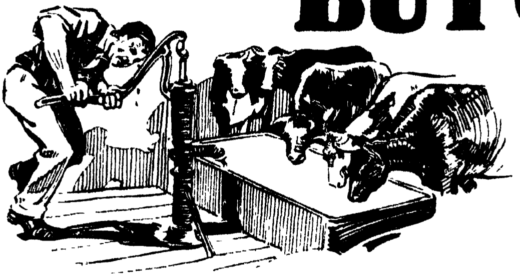

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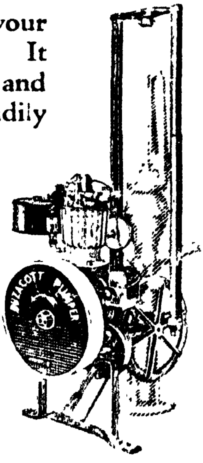

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VOL. XXXIII. PART 1. JANUARY 1, 1922.

Agricultural Gazette of New South Wales.

The R.A.S. Field Wheat Competition.

[In 1921 the Royal Agricultural Society, for the fourth time, promoted a Field Wheat Competition, and, with the approval of the Minister for Agriculture, Mr. W. R. Birks, B.Sc. (AGR.), Inspector of Agriculture, acted as judge. The following extracts from the report furnished to the President and Council of the Society by Mr. Birks is published as likely to be of interest to all wheat-growers.]

THE area covered by the current competition embraces the wheat-growing districts lying between the line Singleton-Gulgong-Coolah-Coonamble and the Queensland border, that is to say, the North-western Slopes and Plains. Although, in point of present production, this part of the wheat belt is of lesser importance, nevertheless the area of good wheat lands it contains is so large that it is difficult to set limits to its future development; and it is unfortunate for the reputations of many well-known and growing wheat centres that they were not represented, or at best, poorly represented in this competition.

Eighteen exhibits in all were inspected on the judging tour, which took place during the second and third weeks of November. The general standard of excellence of the crops submitted was very high indeed, and the estimates of prospective yields ranged from seven to fifteen bags per acre.

This by no means represents the probable range of yield of the district crops as a whole. In every locality a marked feature of the wheat crops was their irregularity in quality and promise of yield. This is to be expected in a district which has not the same wheat-growing tradition behind it as is the case with the southern parts of the State, and in which systems of farming have not been so thoroughly developed and crystallised. Probably the factor chiefly responsible for this irregularity is the protracted seeding; the late sown crops everywhere labour under a serious handicap. This is emphasised by the special character of the present season. The rainfall for the seeding and growing period, taking a rough average for the whole district, may be represented as follows:—April, ½ inch; May, 5½ inches; June, 5 inches; July, 4 inches; August, ¾ inch; September, 1½ inch; October, 2 inches; November (1st half), 1 inch.

Throughout April and up to the third week of May conditions were favourable for seeding. Thereafter more or less heavy falls occurred almost weekly until the end of July. Thus, where seeding was not completed in May, the operation was not only made tedious and unsatisfactory by the sodden condition of the ground, but also in some cases it was delayed until late July, or even early August. From late July to mid-September, a period of about seven weeks, comparatively dry warm weather occurred. This was ideal for the early sown wheat, which was well established, and stooled out and ready to develop top growth. With late sown crops, however, the tendency was to cause premature ear development and " spindly " growth. October and November rains were timely and sufficient, and this fact alone saved the July and August sown wheat from failure, whereas a good yield from early crops was already assured.

A bountiful rainfall, as indicated above, favoured the heavier types of soil which predominate in the district. The great majority of the soils met with were of either basaltic or alluvial origin. On such rich land wheat-growing is a little more precarious and requires more care in certain details of cultivation and treatment than is the case with the typical red wheat soils of the west. In particular, rank growth is to be guarded against, and in this connection, it is significant that three of the heaviest crops inspected had been planted early and subsequently fed off until quite late in the winter.

With respect to preparation of land prior to seeding, it is generally recognised that the long winter-fallow, characteristic of modern Riverina practice, is not so essential in the north-west. In fact, with these rich soils it has a tendency to increase the risk of rank growth and lodging. Further, with a rainfall more evenly distributed throughout the year, and almost assured heavy summer falls, the " short " or " summer-fallow " is usually sufficient for purposes of moisture conservation. In fact, wheat is grown successfully for several years in succession on the same ground provided early ploughing after harvest is practised, giving time for a second working before seeding. This is the method which was employed in the case of the winning crop, the seventh in succession on that particular paddock; and the extraordinarily fine showing of that crop, both as regards yield, evenness, and freedom from weeds and disease, is an eloquent testimony, not only to the fertility of the land, but also to the energy with which it has been farmed.

However, in the hands of the farmer of average capacity, the practice of growing wheat after wheat, apart from the risk of a dry season, leads to three other serious dangers, namely, the harbouring of diseases, the encouragement of black oats and other weeds, and the mixture of varieties. Before considering these defects as met with in the competition crops, it may be pointed out that of those promising a yield of ten bags or more, the majority were grown on land which had not grown wheat the previous year, that is, the land had been either treated as long fallow or grazed throughout the year and ploughed during the summer.

The most general defect observed was that for which deductions are made under the heading " trueness to type." None of the crops seen could be recommended as being fit for " pure seed wheat " purposes. Apart from the very general presence of strangers arising from the self-sown wheat from previous crops, this comparatively low standard of purity may be attributed to the facts that fewer local farmers are specialising in the production of pure seed, and that, generally, less importance is attached to " pedigree " in wheat than the subject deserves.

In the matter of weeds most of the crops inspected were reasonably clean. There were a few cases of small percentages of black oats, charlock, thistles, and other common weeds, but in only one case was a heavy deduction made, and in that case, unfortunately, in a crop otherwise of the very highest promise. This was attributable to careless and continuous cropping by a previous owner, together with the open and friable nature of the soil, rendering control difficult. Here, in addition to black oats, there was a considerable quantity of iron weed, the seed of which is always difficult to separate from wheat.

Of diseases, too, the competing crops were unusually free. Only a trace of flag smut was seen; loose smut, though fairly common, was nowhere present to a serious extent; ball smut (or bunt) was seen in only three instances, and then only in small quantities.

This comparative freedom from the smut type of diseases indicates a generally efficient system of seed treatment; it also indicates that reinfection in the soil after seeding is less likely in a season such as this, following a wet summer, when disease spores have had every opportunity of germinating before the seed was put in the ground.

Two minor attacks of take-all were met with, and in each case the land had been subjected to continuous cropping with wheat for a number of years.

Rust is, of course, the most important cereal disease in this part of the State. Its development depends on the occurrence of humid conditions during the spring and early summer, which conditions are more often met with in the north than elsewhere.

It has already been pointed out that during the late winter and early spring this year a comparatively long warm dry spell occurred. This, no doubt, checked the rust, and accounts for the fact that none of the crops was badly affected. Rust on the flag was practically universal, but nowhere serious; all the earlier crops were quite safe in this regard, and, at worst, the latest crops may suffer a little in the pinching of the grain.

So general is the threat of rust that rust-resistance is one of the main considerations in the selection of varieties for the district. Other important factors are the ability to "stand up" to heavy weather, and the ability to take advantage of late rains, that is to say, a comparatively long-growing season.

For these reasons, no doubt, the most popular varieties met with were Currawa, Yandilla King, and Bomen. No other variety occurred more than twice in the entries, and in contrast to the western and southern districts, Federation and Hard Federation are decidedly unpopular. Only three entries of these two wheats were made, and those were in the more westerly and drier parts of the district.

In no instance was superphosphate used on any of the farms visited. This is another feature of north-western farming in striking contrast to southern practice, and for the time being, it must be regarded as sound, since in careful trials in this district the use of superphosphate has not given generally satisfactory results.

In reviewing the general prospects of wheat-growing in the north-west from the standpoint of the facts and evidence brought out by this competition, it may be said that the lines along which development is most likely to take place, and the methods which will probably lead to the quickest improvement, may be grouped as follows:—

(1) A period of resting of all land from wheat, not less often than one year in three. During that year the land may be treated in various ways, *e.g.*, the ordinary long fallow (more applicable to the drier western areas); close grazing throughout the winter and spring, followed by a summer fallowing not later than January; or an intercultivated summer crop, such as maize, may be grown, which will occupy the ground throughout the summer, and a light discing in autumn will put the land in good condition for wheat. The latter practice is applicable to the more favoured eastern portions of the district. On some farms possibly all three of the above methods might be employed.

This allows for at most two wheat crops in succession. For the second of these it is essential that the stubble ground should be ploughed not later than February; that is to say, no crop should be sown on land which has not had at least a "short fallow."

Further, whenever possible, oats or barley should be substituted for wheat as the second or stubble crop.

(2) The working of the fallow will be conditioned largely by the rainfall. Two or three cultivations may be necessary between first ploughing and seeding to keep down weeds. In any case a working immediately before seeding is essential in order to give the wheat at least an equal opportunity with the weed seeds which are, to a certain extent, ever present. It is sometimes sought to effect this purpose by cultivating or ploughing the seed in. This method, however, puts the wheat at an indiscriminate depth, some of it much deeper than the bulk of the weed seeds, which thus get the advantage of an early start. For the present, therefore, the established method of seeding still holds; this consists of discing or cultivating first sufficiently deep to cut and turn in all weeds, followed by the drill, set comparatively shallow, within twenty-four hours at latest.

(3) Seeding at the right time, as pointed out above, is probably the most essential factor in successful wheat-growing; and to enable this to be done, early ploughing, *i.e.*, a fallow of longer or shorter duration, is necessary, if for no other reason.

The exact date after which it is unprofitable to sow any particular wheat cannot be definitely foretold, owing to seasonal

DETAILS of AWARDS.

Competitor's Name and and Address.	Variety.	No. of Crops	Type of Soil.	Seed sown	Date sown	Prior condition of the land	Points Awarded for— Trueness to type Max. 20	Freedom from Disease. Max. 20.	Evenness. Max. 20.	Freedom from weeds.	Condition and and general appearance.	Yield	Total.
				lb						*	†	‡	
J. T. Maunder, "The Wilga," Pallamallawa.	Bomen	7	Heavy clay loam	45	15 April	Short fallow	15	19	20	29	28	42	153
T. P. Kelso, "Bithramere," Tamworth.	Yandilla King	8	Volcanic clay loam	50	23 „	Long fallow	17	16	19	28	26	40	146
Forge and Sons, "Oxley," Tamworth.	Currawa	10	Heavy clay loam	56	14 „	Grassland	16	20	19	30	25	33	143
E. A. Burcher, "Melrose," Duri	Yandilla King	5	Volcanic clay loam	60	6 May	Summer fallow	17	19	19	19	23	45	142
L. A. O'Rourke, Tambar Springs.	Cedar and Currawa	16	Gravelly red clay loam.	53	31 May-June 20	Wheat stubble	17	19	19	27	27	32	141
C. Proudfoot, "Goonoo Goonoo," Tamworth.	Bomen	9	Whitish clay loam	60	6 May	Short fallow	17	19	19	27	27	31	140
D. Shepherd, "Drummoyne," Narrabri.	Champion and Yandilla King.	4	Semi-alluvial loam	30	15 June	Wheat stubble	14	19	18	26	23	39	139
Mrs. S. L. Baker, Gunnedah	Hard Federation	12	Semi-alluvial loam	40	20 May	Summer fallow	17	15	15	28	25	37	138
M. Bowler, "Warrall," Tamworth	Bunyip and Currawa	7	Heavy clay loam	52	27 April	Long fallow	15	18	19	26	26	34	138
H. J. Eyke, Curracabar, Baan Baa	Bomen	7	Light shaley loam	34	4 May	Wheat stubble	18	19	18	26	27	30	138
J. N. O'Rourke, "Fairfield," Tambar Springs.	Purple straw	6	Gravelly red loam	50	24 May	Wheat stubble	17	17	19	26	27	32	138
O. McCauley, Oban, Coolah	Marshall's No. 3 and Federation.	2	Red sandy loam	56	30 May	Grassland	18	18	19	25	24	34	138
W. J. McEwan, "Glendoone," Mt. Russell.	Currawa	8	Volcanic clay loam	45	15 July	Grassland	17	18	17	25	25	32	134
A. E. Faulks, "Murroon," Tamworth.	Currawa	7	Heavy clay loam	45	10 May	Wheat stubble	15	17	18	29	28	24	131
A. Floyd, Tambar Springs	Currawa and Florence	15	Gravelly red clay loam.	50	30 July-11 Aug.	Wheat stubble	17	19	20	28	27	20	131
E. Coulton, "Cavell Hill," Gravesend.	Comeback and Florence	5	Whitish clay loam	60	15 May	Wheat and maize stubble.	14	19	19	26	25	23	126
J. E. McDonald, Ulamambri	Federation	2	Red sandy loam	52	20 May	Summer fallow	15	17	19	23	24	26	124
H. Foote, Gunnedah	Yandilla King	12	Semi-alluvial loam	45	30 „	Wheat stubble	9	15	15	26	20	25	110

* 1st crop, 24 points; 2nd, 25; 3rd, 26; 4th, 27; 5th, 28; 6th, 29; over six crops, 30.
† 1st or 2nd crop, 24 points; 3rd or 4th, 25; 5th or 6th, 26; over six crops, 28.
‡ 1 point for every bushel of apparent yield.

variations. However, a good working objective is to have all late and midseason wheats in by the middle of May, and the early, quicker-maturing sorts by the middle of June at the latest; this will mean, of course, that portion of the crop at least, will tend to rank growth and will need eating off, especially that sown on long-fallowed land; and provision for this kind of treatment must always be made.

(4) The choice of varieties and selection of good, pure seed are by no means the least factors of success. In the matter of varieties the district is already generally alive to the necessities of the case, as evidenced by the general cultivation of such more or less rust-resistant, heavy yielders as Yandilla King, Bomen, Currawa, and Cleveland. Florence and Canberra are probably the best quick-maturing sorts for late sowing, while the standard wheats of other districts, viz., Federation and Hard Fe eration, are restricted to the western and south-western parts of the district.

In conclusion, it may be pointed out that a most satisfactory feature of the competition is that, although most of the crops entered were very fine indeed, the trophy winners were of outstanding excellence, and obviously the product of consistent good farming. Particularly is this the case with Mr. Maunder's entry. This was portion of a remarkably heavy, clean, and uniform paddock of wheat, and it is doubtful whether any similar area of crop on this farm would have gained a lesser distinction.

Particulars of the cultural treatment of the crops entered and the points awarded in the judging are set out in the table on page 5.

NEWLY RECORDED WEEDS.

THREE new weeds have been recorded at the National Herbarium, Sydney :

Chenopodium Vulvaria L., " Stinking Goosefoot," so named from its strong saline, fishy smell (Yass district, per Chief Inspector of Stock). Common in most countries in fields and waste places. According to Ewart, in " Weeds and Poison of Victoria," p. 75, it is widespread in Victoria.

Sisymbrium Sophio L., called " Flixweed," or " Fluxweed," from its use in dysentry, a disease that was formerly called " flux " (Ando, Bombala district, per Stock Inspector Kenny). One of the Edge Mustards, very widely distributed throughout Europe and Asia. As in the case of allied species, there is a danger of it becoming a menace to agriculture in this country, conditions being favourable to its development. It is a new weed for the Commonwealth.

Centaurea Picris L., " Hard Heads." This spineless species is a native of the Caspian region, and has recently made its appearance in the Henty district. According to Mr. F. H Shults it was introduced with lucerne seed two years ago, and is now proving a difficult weed to eradicate. It was recorded in Victoria in 1907.—W. F. BLAKELY, National Herbarium, Botanic Gardens.

Farmers' Experiment Plots.

MAIZE EXPERIMENTS, 1920-21.

Southern District.

G. C. SPARKS, Inspector of Agriculture.

MAIZE experiments were carried out with the co-operation of the following farmers:—

E. M. Herring, "Sheen," Batlow.
A. N. Stacy, "Camelot," Tumut
F. T. Dowling, Tumut Plains.
E. Hargreaves, "Rosehill," Wagragobilly.
J. A L. Thompson, "Deepwater," South Gundagai.
A. J. Kidd, "Morningside," Bongalong

The experiments comprised the usual variety and fertiliser trials, except that at Tumut Plains, which was for fertilisers only. The other Tumut experiment was so damaged by cockatoos that the results were not comparable.

The Season.

The season was a favourable one. The continuous rains of late winter and early spring gave moist seed-beds, and the cool, wet early summer weather, culminating in the heavy rain of December, gave the crop a splendid start; and although a period of hot, windy and almost rainless weather was experienced in January and February, there was a return of moist conditions in the early autumn and the season had a satisfactory finish.

Cultural Details.

Batlow.—Chocolate loam, basalt. Ploughed mid-August; ploughed and sown 19th October; harrowed 23rd November; scarified 1st January. Effective rainfall, 1,179 points.

Wagragobilly.—Heavy black alluvial soil. Ploughed 20th October; harrowed twice; springtoothed 20th November; sown 23rd November; scarified once and weeds hoed out. The seeding of this experiment was unavoidably delayed (the rest of the experiments were October-sown), and the dry period mentioned above, which seemed to be unusually severe at this centre, caught the plots during cobbing, yields being somewhat depreciated. Effective rainfall, 842 points.

South Gundagai.—Light alluvial soil. Ploughed end of August; springtoothed twice. Sown 7th October. Scuffled and weeds hoed out.

Bongalong.—Alluvial. Dark medium-heavy loam. Ploughed June and September; harrowed; springtoothed; harrowed. Sown 4th and 5th October. Harrowed twice; scuffled twice.

Tumut Plains.—Alluvial. Heavy black loam. Ploughed 17th October; rolled; harrowed twice; rolled and sown 30th October. Harrowed when 6 inches high; scarified tour times and weeds hoed out. Plots rather badly damaged by cutworms, necessitating some replanting, and as the 2½ cwt. superphosphate plot was attacked with the greatest severity results were upset.

Notes on the Varieties.

The variety trials were unmanured. The drills were 54 inches apart, with three grains at distances of 28 to 30 inches, except at Batlow where the drills were 36 inches apart with one grain at 12 inches. At Bongalong planting was done by hand. The departmental recommendations, Funk's Yellow Dent and Leaming, were the highest yielding varieties at two out of the three experiments in which they figured. The former is rapidly growing in popularity, and a greatly increased acreage of this variety can be anticipated during the coming season. There is, however, an objection to Leaming, mainly on account of the small size of the cobs tending to increase harvesting charges.

RESULTS of Variety Trials.

Variety.	Batlow.		Wagragobilly.		South Gundagai.		Bongalong.	
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.
Golden Glow ...	30	34	62	38	...		...	
Wellingrove ...	28	32	...		...			
Brewer's Yellow Dent	25	46	67	47			...	
U.S. 133	25	24	56	49	...		...	
Silver King	22	25			60	0		
Early Canada Flint	22	10	...					
Iowa Silvermine	14	34	...		59	24		
Funk's Yellow Dent...	...		60	0	69	42	92	35
Leaming	...		61	23	67	7	92	23
Leggett's Pride			38	1	62	24	82	45
Early Clarence			54	42	58	28	79	4
Golden Nugget	...		...		57	0	73	47
Yellow Mastodon	...		...		...		67	42
Gold Standard Leaming	...		...		62	24	64	32
Golden King ...	...		54	39	...		...	
Manning White	...		...		64	28	...	
Craig Mitchell	...				56	14	...	
Yellow Hogan			...		54	0	...	
Boone County White	...		...		53	14	...	
Local White (Farmers' Variety) ...	...		...		56	14	...	

The three early varieties, Brewer's Yellow Dent, Golden Glow and U.S. 133, were most favourably received at Wagragobilly. Owing to the uncertainty regarding time of planting consequent upon the snow water in the river, the need for good early varieties is acute in this district, as planting is at times so unduly delayed as to render the use of the local main crop standards out of the question; hence the necessity for varieties of maize that can be depended upon to yield when sown at the very end of the planting season.

Golden King did not fully mature at Wagragobilly, and here also the failure of Leggett's Pride is difficult to explain. The vegetative growth of this variety was quite normal, but cobbing was defective; it was, however, third highest yielder at Bongalong.

It is maintained by many that maize culture at Batlow is a hopeless proposition. It remains to be seen if some of the new varieties will not overcome these local climatic difficulties. A fair amount of maize is fed at Batlow, and at present heavy expense is incurred by haulage from Tumut. The highest yielding variety here, Golden Glow, gave 30½ bushels in the initial experiment, which may be regarded as a satisfactory yield for this locality.

The results of the manurial trials were somewhat conflicting. In three out of four manurial experiments the use of manures generally proved profitable, and in two instances especially so. At Tumut Plains and Bongalong increases of 17 and 15 bushels per acre respectively were given by M5 and 2½ cwt. of superphosphate. At South Gundagai the margins were smaller and the two superphosphate plots failed to give increases, while at Wagragobilly the use of manures resulted in every instance in a decline of yield. This last was, however, probably due to the fact that the manured plots were much more advanced in growth when the dry weather terminated on 28th February than the relatively backward unmanured plot, which made more of its growth in favourable weather. The variety used in all the fertiliser trials was Early Clarence. At Tumut Plains the fertilisers were sown through the maize dropper, but at the other centres they were applied by hand.

RESULTS of Manurial Trials.

Fertiliser per acre.	Tumut Plains.		Wagragobilly.		South Gundagai.		Bongalong.	
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.
Superphosphate, 1¼ cwt. ..	87	54	52	54	58	28	80	51
Superphosphate, 2½ cwt. ...	*		56	51	57	42	94	52
P7, 2¼ cwt.	99	50	53	29	59	42	87	5
P8, 3 cwt.	95	50	...		...		...	
M5, 210 lb.	103	52	54	45	61	49	...	
M6, 2 cwt.	91	4	57	18	62	24	86	43
No. manure	86	48	60	17	58	28	79	4

*Damaged by cutworms.

The composition of the fertiliser mixtures was as follows:—P7, equal parts of superphosphate and bonedust; P8, equal parts of superphosphate and blood and bone; M5, 2 parts superphosphate, 1 part sulphate of ammonia; M6, 5 parts superphosphate, 3 parts chloride of potash.

Green Fodder Trials on South Coast.

R. N. MAKIN, Inspector of Agriculture.

During the past season three plots of maize were sown in the South Coast district for green fodder or ensilage purposes, viz., Mittagong, Bemboka, and Camden. Owing to flood-waters twice covering the plots at Camden no returns were obtained there. The variety of maize used was Fitzroy, which, after many tests, has proved the best of all varieties for such purposes.

The object of the experiment was to ascertain what artificial fertiliser should be used to increase the yield of fodder. The maize was sown in drills 3 feet apart, and seed and manure sown by the maize planter, using about 30 lb. seed per acre. The plots were sown in October and November, 1920.

It will be seen on glancing at the returns that at Bemboka M6 returned the highest yield, and at Mittagong superphosphate, 2 cwt., came out best. On each plot P7 ran into a good place ; this mixture is the most dependable of mixtures tried on green fodder crops so far, and it can be recommended also because it is one the farmer can mix with ease.

RESULTS of Fertiliser Trials.

Fertiliser per acre.	Bemboka.				Boys' Farm Homes, Mittagong.			
	t.	c.	q.	lb.	t.	c.	q.	lb.
M6, 2 cwt.	15	15	2	2	10	9	1	24
M7, 1⅝ cwt.	11	15	2	14	8	13	0	4
M5, 1⅞ cwt.	....				12	4	0	22
No manure	14	9	1	26	10	12	2	0
P7, 2 cwt.	15	7	0	0	12	7	2	0
Superphosphate, 1 cwt. .	14	9	1	26	9	5	0	20
,, 2 cwt. ...	15	10	0	0	12	18	0	4

The composition of the fertiliser mixtures was as follows :—M6, 5 parts superphosphate, 3 parts chloride of potash ; M7, 10 parts superphosphate, 3 parts chloride of potash ; M5, 2 parts superphosphate, 1 part sulphate of ammonia ; P7, equal parts superphosphate and bonedust.

THE LUCERNE SEED TO PLANT.

THE choice of seed is of vital importance in getting a good stand of alfalfa [lucerne]. No seed can give a perfect stand on a coarse or loose seed-bed ; on the other hand, poor seed cannot produce a good stand on the best of seed beds. Because of this, attention should be given to the quality of the seed.

Quality of alfalfa seed may be determined approximately by observing the colour, the plumpness, and the number and kind of weed seeds it contains. Seed of a bright yellow colour with an occasional tint of light green is best, for this indicates maturity. Stains of any sort indicate weakened vitality, particularly if many seeds are decidedly dark brown, or even reddish brown. Well-matured seed may become badly discoloured if thoroughly wet during harvest. A distinctly green colour indicates lack of maturity or frost injury. Seed will be of a bright yellowish colour only when properly matured and properly harvested in favourable weather.

Immature seed may be badly shrunken, but usually it will also be dark-coloured, or distinctly green. Immature seed, or mature seed that has been discoloured by wet weather, is usually low in power to germinate. Moreover, the seeds that do germinate are likely to produce sprouts too weak to start proper growth. Bright seed that is too old will take on a dull colour, and gradually change from yellow to brown. Vitality ordinarily decreases about in proportion as the brightness fades and the colour darkens.—Circular No. 45, Utah Agricultural College Experiment Station.

Field Experiments with Winter Fodders.

COWRA EXPERIMENT FARM.

C. McCAULEY, Experimentalist.

[The Experiments Supervision Committee, under whose control these experiments are being conducted, wish to draw the attention of farmers to the fact that the results are only those of one year's trial, and that final conclusions cannot yet be drawn.]

THE object of this experiment, which is now in its second year, is to determine the most suitable winter fodder to grow for stock on the Central-western Slopes. The land used is a sandy loam, which, since 1913, had been under lucerne for hay and grazing. The land was disc-ploughed on 8th and 15th October, 1920, re-ploughed 20th and 21st January, 1921, disc-cultivated 18th and 21st February, and spring-tooth cultivated and harrowed on 3rd and 7th March. The seed-bed was in excellent tilth, and free from weeds at sowing time, when the following crops were sown at the rates indicated :—Sunrise oats, 40 lb. per acre ; Algerian oats, 40 lb. ; Zealand wheat, 42 lb. ; Hard Federation wheat, 42 lb. ; Cape barley, 40 lb. ; Skinless barley, 40 lb. ; canary seed, 16 lb. ; Grey field peas, 8 lb. ; Slav rye, 60 lb. ; rape, 5 lb. ; Swede turnips, 5 lb.

The plots were sown on 11th and 12th March, 1921, superphosphate being applied to all the plots at the rate of 60 lb. per acre. The rape, turnips, and field peas were sown in drills 2 feet 11 inches apart, and cultivated on 7th May and 15th June. Owing to the excellent season, all the plots (with the exception of Canary seed, which started off well, but was checked by frosts and eventually succumbed completely to take-all) made good growth, though the yields of rape and field peas were much lighter than those of the cereal crops. Algerian oats and Zealand wheat were 3 feet high by the middle of August, but were too late to yield their maximum amount of fodder during the winter months.

The Sunrise oats (which lodged badly as the result of heavy rains in June and were harvested with the greatest difficulty), Cape barley, Skinless barley, Hard Federation wheat, rye, rape, and field peas were all harvested on 2nd and 22nd July, 1921. The season continued favourable, although the second growth of the different plots was retarded by heavy frosts. The Sunrise oats, rye, rape, and field peas made the best growth. The Hard Federation wheat and Skinless barley did not make sufficient second growth to harvest. The Algerian and Sunrise oats, Zealand wheat, Slav rye, Cape barley, Grey field peas and rape were harvested on 12th October, 1921, and the Swede turnips on 10th October. All the plots were weighed immediately after cutting.

Take-all (*Ophiobolus graminis*) not only entirely killed the canary seed, but also affected the oats, wheats, and barleys slightly. The Algerian oats were badly affected with loose smut (*Ustilago tritici*), and all the cereal plots except the rye were infected with rust.

The rainfall for the year was as follows:—January, 116 points; February, 41; March, 332; April, 375; May, 311; June, 249; July, 183; August, 220; September, 183; October, 126. Total, 2,136 points. The rainfall during the growing period totalled 1,665 points.

The yields were as follows:—

Varieties in order of merit (based on percentage yield).	Yield per acre (based on percentage).			
	t.	c.	q.	lb.
Sunrise oats (average of checks) ..	11	6	0	1
Algerian oats	10	12	0	1
Cape barley	9	5	3	16
Slav rye	8	19	0	23
Rape	5	14	3	16
Swede turnips...	5	9	2	15
Skinless barley	5	0	3	19
Zealand wheat	4	8	0	19
Hard Federation wheat	4	8	0	9
Grey field peas	1	18	2	0

Conclusions.

The results of this experiment to date show that Sunrise oats, Cape barley, and Slav rye have proved themselves the best winter fodders. They make early rapid growth, and maintain a supply of green fodder during the winter and early spring months.

Algerian oats and Zealand wheat yield well, but their early growth is very slow, and they do not yield their maximum amount of fodder until the spring months. Hard Federation wheat has proved itself unsuitable for green fodder for this district.

The results from rape, Swede turnips, and field peas cannot be compared with those from the cereal crops. They are also very difficult to harvest accurately, and will not be included further in these trials.

WHAT THE COUNTY AGENT ACHIEVED.

"YOUNG man, if you have come out here to get me to plant a little dab of this and a little of something else, and expect me to keep records on it and report to you, you can drive on, and the sooner the better."

According to the *Weekly News Letter* of the United States Department of Agriculture the county agent was undeterred by such a forbidding reception. He cultivated that farmer, and now reports that since the conversation "the farmer has been induced to get a pure-bred bull, to build a mile of pasture fence, build a milk-house, buy a cream-separator, get a gas engine for his feed mill, build a new barn, buy and grow pure-bred hogs, plant pasture grasses, clean a field of stumps, give a small piece of ground for a school demonstration plot, build a sweet-potato house, grow legumes in his maize, plant lucerne, sell cream to the creamery, and a number of minor things."

Very good, but he seems to have needed the county agent!

"Foot Rot" of Wheat Caused by the Fungus Helminthosporium.

C. O. HAMBLIN, B.Sc., B.Sc.Agr., Assistant Biologist.

A DISEASE has appeared among wheat crops in New South Wales in widely separated areas this year. A considerable amount of damage has been recorded for some crops, the estimates of the damage varying from 2 or 3 up to 85 and 90 per cent. Some crops have completely failed.

On examination of the areas one of two parasites is invariably encountered, either the true "Take-all" fungus (*Ophiobolus graminis*) or *Helminthosporium*, which gives rise to a "foot-rot" condition closely resembling the Take-all.

The writer is of opinion that the *Helminthosporium* disease—which it is proposed to style "Foot-rot"—has this year been responsible for far more damage than the better known Take-all. An investigation of these Foot-rot and Take-all conditions has been in progress for some time, and it has been decided to publish such an account as will make clear, for the benefit of wheat-growers, the general results of this inquiry, particularly as it concerns the newly recognised Foot-rot disease. A full account of the investigations will be published shortly as a scientific record.

Symptoms of the Disease.

Whereas Take-all (*Ophiobolus graminis*) usually attacks wheat in clearly defined patches, it has been found that Foot-rot (*Helminthosporium*) does not necessarily occur in patches. Scattered plants affected by the disease can frequently be found extending throughout the whole of the crop. The writer has, however, seen wheat affected by this disease in clearly recognised patches. In such cases there are other features to indicate which disease is affecting the crop.

In some cases the most noticeable effects of the disease only become visible when the plants are approaching maturity. Some plants appear to be affected even in the seedling stages, and it is probable that many germination failures are attributable to *Helminthosporium*. A mature plant discovered to be affected by the disease in its later life, when the head should be well formed and filling out, shows the following symptoms:—

The stooling is very poor—sometimes only one straw develops to form a head, but more commonly two or three straws develop and the others remain undeveloped, having been stunted by the fungus.

In all cases the root-system is very poorly developed. Frequently, as is also common in Take-all, there is an abnormal development of root hairs close to the culm, giving the dead or dying root a "fuzzy" appearance. Secondary roots are often thrown out above the first node of the affected straws. When diseased plants are pulled up in the field the roots break easily, being brittle and rotted.

The base of the plant at and below the ground level shows a most characteristic brownish marking of the leaf sheaths and the straws which they enclose. The term "tobacco-coloured" (used by Bolley with reference to similar conditions*) seems very appropriate; "cresote-coloured" is also a good alternative. Sometimes these marks appear in the form of brownish streaks or as spots; sometimes there is a uniform discolouration of the sheath and straw. When the plant is dead the colour of the base of the plant is an ashen grey. If the dead straw is examined at the base it is seen that the condition of rot and decay extends right through its tissues. Microscopic examination of the straw shows that the fungus mycelium is ramifying throughout as well as forming recognisable patches externally.

[In the writer's experience of the true Take-all (*Ophiobolus graminis*) the base of the plant is generally definitely "blackened" rather than "brownish" or "tobacco-coloured." so that some separation of the disease on macroscopic and naked-eye symptoms is possible. While anyone entirely familiar with the two diseases could separate them fairly readily in the field, it is very difficult to provide a description which will entirely prevent their confusion by those unfamiliar with the diseases.]

Affected plants reach varying states of maturity. Sometimes, owing to the interference with the nutrition of the plant brought about by the fungus on the basal parts of the straw, the head is formed but no grain is set; sometimes grain is set in some spikelets but is very imperfect in others; sometimes the grain is badly pinched throughout, of poor colour, and never attains a desirable plumpness. The heads are rarely fully developed, tapering points and failure of the lower flowers being common. The tendency to produce light grain and pinched grain of poor quality makes the disease a serious one for the wheat-grower generally. Where the disease only occurs widely scattered through the crop, diseased plants head out and ripen off earlier than the healthy plants in the crop, and, although they have attained much the same height and development, pinched grain results. If a search be made in such cases, quite a proportion of plants in the crop will be found not to have developed fully at all, and plants with single straws and unfilled or quite empty heads will also be found to occur. If the grower assesses the damage due to the disease from this source, he will find that many crops will show losses ranging from 2 per cent. to 10 per cent. Where the disease is bad large patches occur, and a much larger proportion of "single-straw" plants is seen. Numerous empty heads are found at harvest time. The writer has this year seen complete failures of crops in some districts of the North-western and Central-western Slopes.

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* See Bulletin 107, N. Dakota Agr. Coll. Expt. Stn., Dec, 1913, page 57.

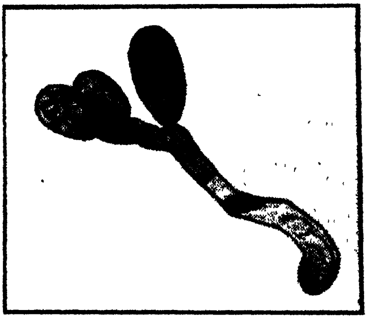
[So far as the writer's experience of *Ophiobolus graminis* is concerned, Take-all plants rarely produce any form of grain. The head is whitened and the glumes empty, and the plants rarely attain normal height, the growth being exceedingly stunted. This appearance of disease is separable from the Foot-rot due to *Helminthosporium.*]

It has been noted that plants attacked by Foot-rot are always apparently more susceptible to leaf affections than healthy plants growing alongside, such fungi as *Septoria, Erysiphe* (mildew), and the rusts (*Puiccinia graminis* and *P. triticina*) being found on the flag and straw.

History of the Disease.

This Foot-rot disease closely resembling Take-all has been in evidence among the wheat crops of the State for some years, but the cause has not hitherto been recognised and attributed to any specific fungus. Investigations have shown that the fungus *Helminthosporium* is the parasite responsible. It occurs as a parasite on living plants, and also as a saprophyte on the dead remains of the wheat plant.

From records of examinations made in the Biological Branch, I find that as far back as November, 1913, Mr. W. A. Birmingham recorded the genus *Helminthosporium* on wheat submitted for examination and closely resembling Take-all. This wheat was from bare patches in crops in the Bathurst district.



Fragment of the mycelium of the fungus.
Note the immature spores.

Mr. J. T. Pridham, Plant Breeder to the Department, published an article in April, 1920,* in which he drew attention to "An Obscure Disease in Wheat." Since then F. L. Stevens, the American pathologist, has published an account of a "Foot-rot" of wheat in Illinois, proved to be due to *Helminthosporium.*† This showed that an outbreak previously regarded by the Americans as Take-all was really a specific disease due to another organism than *Ophiobolus graminis*, the fungus which the veteran Australian pathologist D. McAlpine, had shown to be the cause of Take-all in Australia‡.

During 1919 I examined a specimen from Werris Creek, N.S.W., in which *Helminthosporium* was detected. The plants were stunted, apparently weak, and at the same time heavily infected in the flag by wheat mildew (*Erysiphe graminis.*) The spores of *Helminthosporium* were found in association with brownish mycelium at the base of the plant near the ground level.

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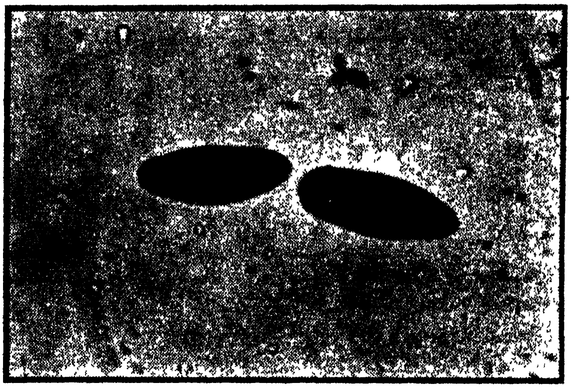
* "*Agricultural Gazette* of N.S.W., vol. xxxi, Part 4, April, 1920, page 229.

† See "Science" n.s., 51, page 517–518, 21st May, 1920.

‡ "Take-all and Whiteheads in Wheat," D. McAlpine, *Journal of Agriculture*, Victoria vol. II, 1903–4, pages 410–426.

Following on the publication of F. L. Stevens' note in "Science," cultures of *Helminthosporium* were prepared from a series of specimens submitted by Mr. Pridham from Cowra Experiment Farm in December, 1920. Mr. Pridham had already drawn my attention to what he thought was a form—possibly a new form—of Take-all. A few preliminary experiments made indicated the *parasitic* nature of the fungus *Helminthosporium* which had been isolated.

In a publication by Mrs. Stakman* a disease is recorded from Minnesota, U.S.A., which causes a foot-rot of seedling wheat, and may result in the death of plants. It is stated to be widespread and to infect many grasses. It also occurs on barley and rye. It is said to be seed-borne and not eliminated by the ordinary formaldehyde treatment (pickling) prevailing in the districts affected. The lesions are brown at first, but later become dull tan in colour with a distinct brown border, and secondary infections may occur on leaves, nodes, internodes, glumes and seeds. Mrs. Stakman states that the only effective control consists in the use of seed from uninfected fields and in good cropping methods. Detailed studies on control methods have not yet been made. On older plants the disease is often associated with *Septoria* and *Fusarium*. Mercuric bichloride and long soaking in formaldehyde reduced the amount of *Helminthosporium* in the grain.



Mature spores of the fungus *Helminthosporium*.

In a bulletin published in 1913† the fungus *Helminthosporium* is recorded as a parasite of wheat, and its presence on and also inside the wheat grain is also recorded. Mr. W. L. Waterhouse has recorded the genus in association with wheat grains, the hyphae and spores being found on the outer layers of the scutellum, *i.e.*, in an intracellular position.‡

Dr. Butler, the Indian Mycologist, has recorded the presence of the genus *Helminthosporium* on Indian wheats, and also on oats, barley, sugar-cane, rice, Jowar, maize and *Pennisetum typhoideum*. Several species are involved

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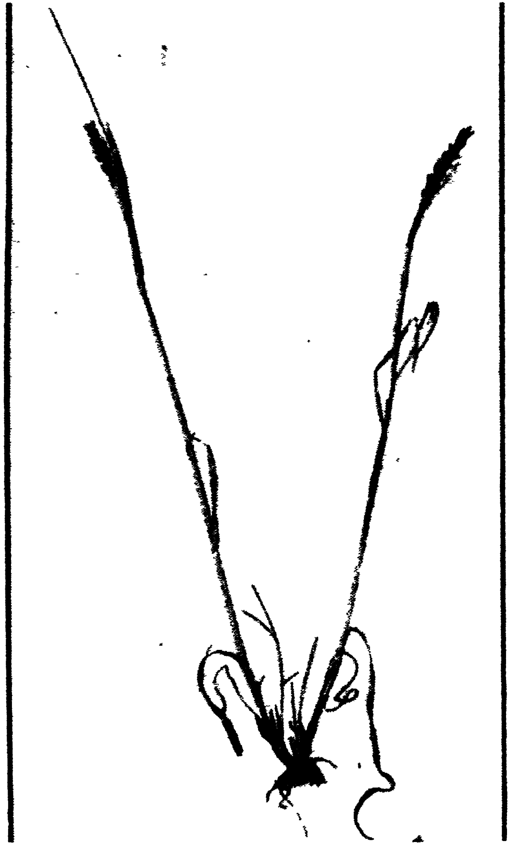
* "A Helminthosporium Disease of Wheat and Rye," Louise J. Stakman, University of Minnesota, Agricultural Experiment Station, Bulletin, 191, July, 1920.

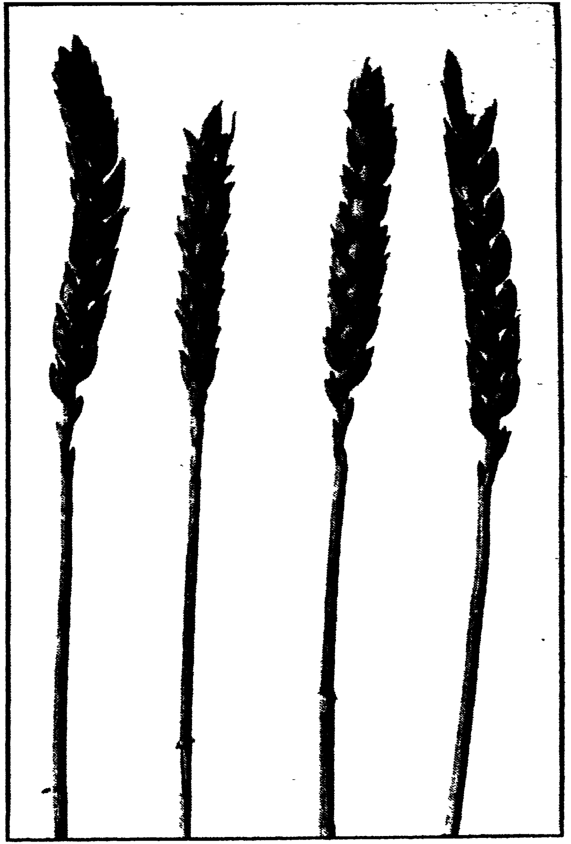
† "Soil Troubles and Seed Deterioration, Causes of Soil Sickness in Wheat Lands." Bulletin 107, N. Dakota Expt. Stn., H. L. Bolley.

‡ *Annals of Applied Biology*, vol. VIII, No. 2, August, 1921, pages 81–82, "On the supposed occurrence of Seedling Infection of Wheat by means of Rusted Grains." W. L. Waterhouse.



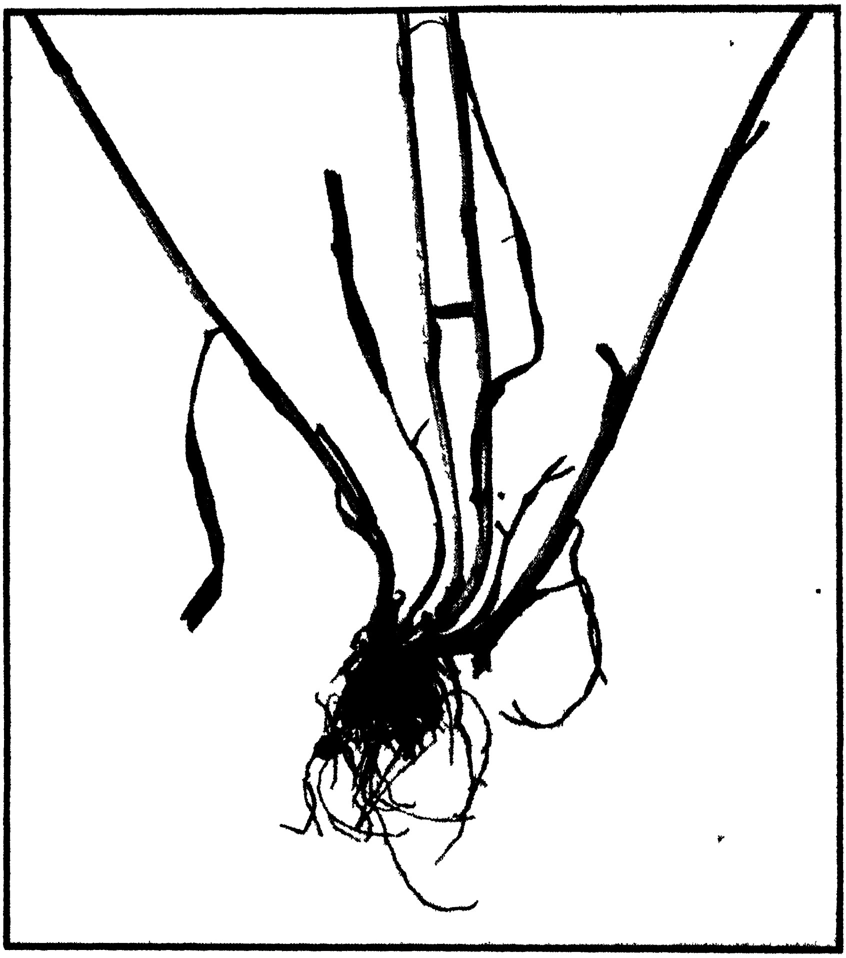
Plant of Hard Federation affected by the Foot Rot.

Note the poor root system and scanty stooling. The straw is dark-brown at the ground level.



Types of heads from affected plants.

Variety—Hard Federation



Hard Federation wheat, affected by Foot Rot.

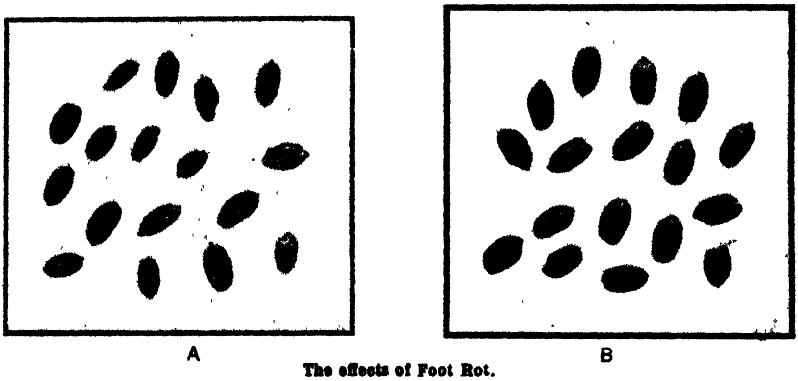
Note the poor stooling, the tendency to form secondary roots, and the diseased straws.

in these attacks. Dr. Butler says: " The species on sugar-cane and rice attack all the hosts on which they have been tried, whereas the wheat and barley species give reciprocal successful results."

In no country have investigations reached a stage where it is possible to clearly define and separate the species or biologic forms of *Helminthosporium* which are attacking the various cereals and grasses. It is therefore not possible at this stage to list all the hosts of the Australian form which attack wheat.

Dr. Butler records* three other fungi causing foot-rot conditions in India, namely, *Rhizoctonia destruens*, a *Pythium* sp., and a *Fusarium* sp. The genus *Fusarium* has been found in association with some foot-rot conditions in New South Wales this year, but its role has not been fully investigated.

It seems likely that further investigation will greatly strengthen the views expressed by Bolley in 1913 and earlier, that a number of genera of the *Fungi Imperfecti*, hitherto regarded as mere saprophytes, will be found to be acting as parasites in many wheat-fields where continuous cropping has been followed.



The effects of Foot Rot.

A.—Pinched grain from diseased plants. B —Plump grain for comparision.

The genus *Helminthosporium* has been found on all our standard varieties of wheat, and on *Hordeum murinum* (barley grass), which is a common pest of wheat fields and fallow, especially in the South-western Slopes and Riverina.

Conditions similar to the Foot-rot described above have been found on oats and barley (both Skinless and Cape).

The relationships of the Australian fungus (*Helminthosporium*) with the form found in America has not been fully demonstrated yet. An effort is being made to secure a comparison of the two forms in culture. It is believed that the Illinois form described by F. L. Stevens and the organism which Mrs. Stakman found attacking wheat are identical.

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[*] Scientific Reports of the Agricultural Research Institute, Pusa, for 1919–20.

While all the standard varieties are attacked, the rapidly maturing wheats, which are generally late sown, appear to have escaped heavy infection.

It is not known if the fungus is seed-borne. Plants which show attack may bear clean seed. This has been fully demonstrated. It is, however, possible, as with the American forms, that the flowers are sometimes attacked and that the fungus is occasionally present in the seed. The writer is as yet unable to express an opinion as to the frequency of such an occurrence under Australian conditions.

Control of the Disease.

To avoid, as well as to control the disease in paddocks where it is already in evidence, the following suggestions are made :—

1. Adoption of some form of rotation in place of the methods of continuous cropping with wheat, which are far too general in our farming districts. Investigation shows that the Foot-rot disease has been worst in paddocks which have been continuously cropped to wheat. While the fact that the fungus may possibly live on other cereals—oats and barley, and more particularly the latter—makes the planning of a suitable rotation difficult in most of our wheat districts, some immediate alteration in routine is necessary where this disease appears. Where, as in the north-west, it is possible to grow summer crops like maize, it is desirable to rotate them with wheat. The clean cultivation given to the summer crop cleans the land of weeds and grasses on which the fungus can live.
2. Use of *Bare* fallow.—Weeds like barley grass should be removed by cultivation. Feeding off with sheep, while it keeps down the growth, does not remove the butts of the grasses on which the fungus can live. Bare fallow should starve the fungus out.
3. Early preparation of the seed-bed to allow a proper decay of old stubble, on which the fungus will live, and with the object of promoting germination and destruction of the spores before sowing.
4. Obtain seed from good reliable sources.—It should be plump and well filled. A sample with many pinched grains should be rejected. All seed should be graded, but it would be unwise to use plump seed graded out of a crop with much pinched grain.
5. The use of superphosphate.—At least 56 lb. to the acre should be used. This practice has never become general in the north-west, and will doubtless prove beneficial, where the disease has been in evidence. The fact that it has not hitherto shown marked increases in yield in manurial trials is no criterion of its value in combating the disease. In the older wheat districts larger amounts should be used.

Weather Conditions.

It seems probable that the disease will be most prevalent in seasons like the one just completed, the second of two relatively wet years proving favourable for its development. In a good season following a long drought, last year's experience (1920) indicates that wheat should be relatively free from Foot-rot disease. It is proposed to initiate the breeding of varieties resistant to the trouble. That there is some hope of success is shown by the American work, Turkey, Red May, and Red Wave being recorded as "highly resistant or immune" to the Illinois form.*

SIMPLE METHOD FOR BOTTLING VEGETABLES.

FAR greater attention is given to fruit bottling as compared with the bottling of vegetables. In certain cases, however, especially where green peas are available for the purpose, or green vegetables are not plentiful during winter, vegetables may usefully be preserved. The following notes on a simple method of bottling vegetables may be of interest in this connection:—

1. Choose young fresh vegetables. Grade for size and colour. Wash and prepare as for cooking, *i.e.*, scrape carrots and celery, peel turnips, &c. Keep white vegetables under water as much as possible to preserve the colour.

2. Plunge the prepared vegetables into a saucepan of fast-boiling salted water (one teaspoonful of salt to one quart of water). Bring the water again quickly to the boil, and allow the vegetables to remain from one to five minutes according to the nature of the vegetables, *e.g.*, peas and delicate vegetables one minute, vegetables of hard texture three to five minutes. Remove the vegetables and place them into a large basin of cold water to check the cooking and to make them firm. Leave them in this until cold (five to ten minutes).

3. Pack the vegetables as tightly as possible into vacuum bottles. Place one teaspoonful of salt on the top of each bottle.

4. Fill the bottles to overflowing with cold water. Place on the rubber ring, glass cap and screw band or clip. Screw up and then release slightly to allow air to escape during sterilisation. Place the bottles in a saucepan with a false bottom. Cover the bottles with cold water. Bring to boiling point in half-an-hour. *Boil gently for two hours.*

5. Lift out one bottle at a time and screw it down tightly before removing the next. When cold remove screws or clips, and test lids to see if they are firm.

The above, taken from the *Journal of the Ministry of Agriculture*, London, may be useful to some growers though it is somewhat general at certain points. The single period of sterilizing would not be too reliable, especially for such vegetables as asparagus, peas and beans, in which cases an intermittent cooking for one hour at boiling point for three successive days would be found a better method.—W. J. ALLEN.

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* See Report of the Chief, Bureau of Plant Industry, October, 1920, page 42.

SUNFLOWERS V. MAIZE AS SILAGE.

FOLLOWING the statement that in many of the colder parts of the United States (localities with a climate similar to that of Glen Innes) sunflowers were found to yield better than maize and to make very good silage, it was decided by the Department to institute local investigations. Experiments were accordingly commenced last season at Glen Innes Experiment Farm, where three separate areas were devoted to this crop.

The largest area comprised a block of two acres, situated on a low-lying clay flat of poor agricultural quality. Sown in drills 3 feet apart on 29th November, 1920, at the rate of 15 lb. seed per acre (Mammoth Russian Grey-seeded variety), the crop reached a height of 4 feet on a rainfall during growth of 670 points. The stems were thin and the heads small. The crop was in full flower on 1st March and was cut for silage on 14th March, yielding at the rate of 4½ tons per acre, as compared with maize 5 tons, sorghum 2¼ tons, and Sudan grass 2½ tons, under identical conditions on ground adjoining. The sunflowers matured four weeks earlier than the sorghum or Sudan grass, and a fortnight earlier than the maize.

The sample of sunflower silage was reported upon by the Stock Assistant in the following terms:—"As compared with maize, the sunflower silage was black and unattractive in appearance and much lower in temperature. It set in a solid lump with little waste, and came out in doughy chunks, having lost the original shape of the particles from the cutter. It proved to be very palatable and was eagerly eaten by the dairy cattle. It did not deteriorate very quickly after exposure to air like the silage made from Sudan grass. A comparison of several crops siloed this season showed that sorghum gave the best silage from the practical feeding point of view, with sunflowers, maize and Sudan grass following in that order."

The past season's results show that it is possible to grow a satisfactory crop of sunflowers and to produce a good silage therefrom. As to whether it will be a sound proposition in relation to mixed farming or dairying to make sunflower silage in preference to maize, only several seasons' experience will reveal. Two points it would seem well to remember—(1) that maize is a dual purpose crop, while there is at present no assured and profitable market for sunflower seed, and (2) that the silage from sunflowers is less bulky than that from maize —L. G. LITTLE, Experimentalist, Glen Innes Experiment Farm.

SUSCEPTIBILITY OF BERSEEM CLOVER TO FROSTS.

THE Experimentalist at Glen Innes Experiment Farm (Mr. L. G. Little) reports that the winter growth of Berseem (or Egyptian) clover at that centre has been disappointing this season, and that under the unusual winter conditions obtaining (generally mild, with exceptionally severe periods at occasional intervals), it has proved to be the most susceptible of all the clovers to frost. Though encouraged by the mild weather to make fair growth, it was cut right back two or three times, and its early spring progress was consequently much behind that of the other clovers, the red (or crimson) and Bokhara varieties especially. In view of these facts, Berseem clover cannot be recommended as suitable for Tableland conditions.—E. BREAKWELL, Agrostologist.

Three Field Wheat Competitions.

THE WESTERN DISTRICT.

[With the object of bringing before farmers the practical value of better farming methods, the Pastoral and Agricultural Associations of Narromine, Gilgandra, and Forbes, during the past season, conducted field wheat competitions. These competitions were conducted quite irrespective of each other, and, with the approval of the Minister of Agriculture, were judged by Mr. H. Bartlett, Inspector of Agriculture. In view of the interest that attached to the competitions in the central portion of the wheat belt, the following summary of his reports is furnished by Mr. Bartlett].

THE three competitions were all well entered, and involved the inspection in the total of eighty crops. The value of sound methods of farming was once more conclusively demonstrated, and the results cannot fail to be instructive to wheat-growers.

It is only two or three years since the idea of these competitions in the central west was conceived, a few leading spirits in the Narromine Association agreeing that it was one of the legitimate functions of the society to educate farmers in this way.

The outcome was the crop competition of 1920–21, organised to demonstrate to farmers on their own farms the advantages and cash value of fallowing and other sound agricultural practice. The effect was just what the promoters had anticipated, and the success of the Narromine competition led to the adoption of the idea elsewhere.

The manner in which the competitions were judged is indicated by the following scale of maximum points:—

Trueness to type, 20 points.

Freedom from disease, 20 points.

Evenness, 20 points.

Cleanliness: first crop, 24 points; second, 25 points; third, 26 points; fourth, 27 points; fifth, 28 points; sixth, 29 points; over six crops, 30 points.

Condition and appearance: first and second crops, 24 points; third and fourth, 25 points; fifth and sixth, 26 points; over six crops, 28 points.

Apparent yield, one point for each bushel of estimated yield.

Each competitor was expected to supply particulars as to the number of crops previously grown on the competition area, whether the competing crop was sown on stubble or fallow, date of seeding, amount of seed and of fertiliser per acre, and the name of the variety.

The Narromine Competitions.

The original entry for this competition numbered twenty-seven, but ten dropped out after having worked the fallow three or four times. The character of the season and their circumstances prevented these farmers from keeping up the work, and as they did not have sheep to help them keep down the growth, the weeds beat them. Sheep were almost essential to clean land last fallowing season, and they were labour-savers as well.

The seventeen farmers who carried the matter through provided valuable object lessons on the subject of the wild oats pest. Clean crops have been grown on ground previously very dirty, and several of the crops afforded a striking contrast to those in neighbouring paddocks, where the methods had not been so good.

The competition was divided into two parts, the first being for 20 acres of fallow land, and the second an open section, governed by the following conditions :—(*a*) Each competitor to enter a patch of 50 acres of wheat, which he might select in one piece from the area under crop on his farm: (*b*) not more than three varieties to be grown on such 50 acres; (*c*) no entrance fee, but every competitor to enter a bag of wheat for competition at the Narromine Show, 1922.

It was notable that of the twenty-seven crops competing in the 50-acre section, sixteen were on fallowed land, and the first nine places in the award list went to fallow, one stubble crop sharing tenth place with a fallow.

Gilgandra Competitions.

The Gilgandra Association held two competitions, one of which was open to all farmers, the other being exclusively for returned soldier settlers. The conditions were very similar to those of the Narromine 50-acre open competition.

Competitors in the open competition totalled nineteen, and six returned soldiers submitted crops for inspection.

Forbes Competition.

Here, again, the conditions were very similar to those already stated, excepting that the area had to be of 150 acres, and that the crops could be distributed over the farm; fifteen entries were received.

RAINFALL at each centre.

—	Fallow Period.			—	Growing Period		
	Narromine.	Gilgandra.	Forbes.		Narromine.	Gilgandra	Forbes.
1920.	points.	points.	points.	1921.	points.	points.	points.
July ...	...	614	210	March ...	254	269	185
Aug. ...	178	179	327	April ...	330	577	302
Sept. ...	441	314	239	May ...	260	413	264
Oct. ...	126	127	127	June ...	400	348	328
Nov. ...	...	143	53	July ...	161	207	136
Dec. ...	451	440	562	Aug. ...	160	151	150
1921.							
Jan. ...	15	213	215	Sept. ...	120	154	178
Feb. ...	29	60	51	Oct. ...	111	113	74

General Comments.

Fallowing is the basis of successful wheat growing.

Could any more striking illustration of that fact be quoted than the results of the above competitions? Excepting in the Gilgandra district, where only a few areas were sown on fallow, very few crops sown on stubble land were considered worthy of entry, and these only where the stubble had been ploughed early in the year, and the crop sown prior to the end of May. Fallowing not only conserves moisture and stores soluble plant-food, but it provides an ideal seed-bed, enabling varieties to be sown at the correct time, which, during the past season, has been the deciding factor between a five-bag crop and a ten.

Hard and fast rules governing the working of fallows cannot be advocated, nor the frequent use of any one of the many farm implements, as conditions vary so greatly—even on the same farm. The class of working suited to one class of soil may actually diminish the returns on a different type, and a working knowledge of the behaviour of soils under cultivation, and a general insight into what constitutes a well-worked fallow, will help considerably towards the attainment of success.

Excepting for a few instances, fallows are best prepared with a mouldboard plough, working to a depth of about 4 inches, the ploughing in the western districts being best finished by the end of August. Although the mouldboard plough is slightly heavier than the disc plough in draught, and the shares have to be reset, the little extra trouble is amply compensated for by the fact that the fallow is left in better condition, and that at least one, and perhaps two, after-cultivations less are required. The mouldboard plough covers the weeds, causing their decay, but the disc plough more often transplants them, with the result that they grow with increased vigour.

After ploughing, the fallow needs to be so worked that weed growth is destroyed, and the surface prevented from caking. Care should be taken not to work the surface too fine, otherwise it will cake very readily, with a consequent loss of soil moisture. Such implements as the harrow, spring-tooth cultivator, disc cultivator or skim plough, will have their uses, and most fallows require to be worked three or four times between ploughing and sowing. Unless weed growth is destroyed, the object of the fallow is largely defeated, and for this purpose sheep are indispensable.

Where black oats are troublesome, good results have been obtained by discing the stubble soon after harvest, thus creating a suitable seed-bed for the germination of weed seeds which are on the surface, prior to the ploughing of the fallow. The paddock will also be in better order for ploughing owing to this discing.

When possible, provided the land is fallowed, good results will follow from the ploughing under of the whole of the stubble crop instead of burning the straw. Many farmers in the "older districts" state that the soil "runs together" more readily than it used to, which is really caused by the

WESTERN Growing-crop Competitions.

Name.	Age of Field.	Present Crop Sown on—	Date of Seeding.	Amount of—		Variety.	Trueness to type and purity.	Freedom from Disease.	Evenness.	Cleanliness.	Condition and Appearance.	Apparent yield.	Total Points.
				Seed.	Super-phos-phate								
Narromine P., A., and H. Association's Fallow Crop Competition 20 acres. 1921.													
	Crops.			lb.	lb.								
W. Gainsford, Yarran Farm	12	Fallow	... 28 April ...	34	Nil.	Canberra	19	20	19	27	27	37	149
B. O'Neil	20	„	... 15 May ...	49	Nil.	Canberra	20	20	18	29	27	33	147
T. Bragg (Estate), Mungeribar	9	„	... 5 June ...	45	Nil	Hard Federation . ..	19	19	19	28	26	27	138
N. Beveridge	10	„	... 10 May ...	55	35	Hard Federation	18	16	18	28	26	32	137
E. P. King, Neath	15	„	... 15 ..	45	45	Canberra	20	20	18	26	26	27	137
Narromine P., A., and H. Association's Open Crop Competition. 50 acres. 1921.													
E. Gainsford, Sylverton	6	Fallow	... 16 April... 3 June ..	30–37	Nil	Currawa, Bunyip	20	20	20	29	25	39	153
D. Kilby, Florida	1	„	... 7 May ...	30	Nil	Hard Federation.	18	20	18	24	24	40	144
W. Gainsford, Yarran Farm	8	„	... 26 April ...	34	Nil	Canberra, Hard Federation ...	17	19	18	29	27	32	142
N. Beveridge, Alvaholm	10	„	... 10 May ...	55	35	Hard Federation	19	19	19	29	25	30	141
Bragg and Edwards, Mungeribar ...	10	„	... 5 June ...	45	Nil	Hard Federation	18	20	18	28	26	30	140
Gilgandra P., A., and H. Association's Open Crop Competition. 50 acres. 192 .													
W. Burrell, Thistledown	6	Fallow ...	15 May ...	30	Nil	Florence	19	17	17	28	27	35	143
W. Burrell, Thistledown	5	Summer fallow	4 „ ...	30	Nil	Rymer	20	17	18	27	25	33	140
T. Watt, Yeallogrin	8	Stubble	15 April ...	40	Nil	Rymer	19	19	18	28	26	29	139
N. Reichelt, Biddon	10	„ ...	20 „ ...	45	Nil	Currawa...	17	19	19	29	26	26	136
F. Horwood, Yaralla	10	Summerfallow	15 April ...	36	Nil	Rymer	19	19	15	29	26	26	134
Gilgandra P., A., and H. Association's Returned Soldiers' Competition. 1921.													
J. Carruthers, Yarrandale	1	New land ...	— May ..	45	Nil	Purple straw	20	19	19	24	23	37	142
T. C. A. Hanckel, Essington	8	Stubble ...	7 „ ...	40	Nil	Rymer	19	19	17	23	26	24	128
F. E. Walker, Hillside	4	Summer fallow	21 April ...	52	Nil	Marshall's No. 3	12	17	15	26	22	24	116
Forbes P., A., and H. Association's Crop Competition. 150 acres. 1921.													
E. Green	10	Fallow	.. 15 May	45	Nil	Florence, Canberra	18	19	19	29	27	29	141
P. Cannon	10	„	... 25 April ..	48–60	Part 40	Canberra, Bald Knob, Steinwedel.	17	19	18	29	26	30	139
Nilon Bros.	1	„	... 30 „ ...	60	40	Hard Federation	18	20	20	23	24	32	137
H. H. Constable	1	Part fallow	... 28 May ...	50	Nil	Hard Federation	18	19	18	24	23	32	134
H. G. Mattiske	20	Fallow	... Apr.-May	45	Nil	Canberra, Federation, Bayah...	15	20	18	27	25	27	132
W. H. Sly	4	Part fallow	... 30 April ...	50	Nil	Canberra, Red Russian ...	18	17	19	26	25	27	132

vegetable matter in the soil having been depleted. The best " cure " would be to plough under a green manuring crop, but failing this, the return of the straw to the soil would certainly improve its physical condition.

Pure and Graded Seed.

The demand for pure seed is an increasing one, and it is generally recognised that unless supplies of stud seed are obtained periodically yields will decrease. Many farmers have their own stud seed plots, and these, in conjunction with the supply of seed from the Department of Agriculture, will have a marked effect upon the improvement of crops within a few years. Mixed samples are always objectionable, especially if the " strangers " in an early maturing crop belong to a late maturing variety. Narromine district was conspicuous for the purity of the crops in these competitions, and judging by the interest shown, they will be even of a higher standard next year.

The grader is becoming an indispensable part of the farm equipment. Farms that possessed a grader were conspicuous by the cleanliness and evenness of the crops, and the owners assert that two years' increased returns will pay for the cost of the machine.

Disease.

The crops inspected were remarkably free from disease. Smut was present in only a few crops, and mostly in such varieties as Federation and Hard Federation when they had not been pickled. Traces of take-all were noted in most crops, but only in a few cases in sufficient quantities to detract from their value. Small amounts of flag smut and rust appeared, mostly in Federation and Hard Federation.

Conclusions.

The P. and A. Associations concerned in these competitions have certainly made a move in the right direction. The crop competitions have created more general interest and healthy rivalry than any other item upon their schedules, and the farmers recognise that the competitions, by introducing better farming methods, will put more money into their pockets and also benefit the district.

Next year, at least four of the agricultural associations in the district will conduct competitions, and it is hoped that within a short time all the associations in the western district will fall into line, thus enabling a champion crop of the western district to be allocated each year.

BANANAS AS PIG FEED.

THE experience of farmers in the Tweed River district seems to show that pigs do well if fed on bananas, especially if the fruit is given with skim milk. Green bananas become soft if they are boiled for twenty minutes, and although rather insipid in taste, are readily eaten. Pigs fatten well when fed in this way.—W. L. HINDMARSH, Veterinary Officer of the Stock Branch.

Cultivation of the Castor Oil Plant.

N. J. BRYCE, Experimentalist, Grafton Experiment Farm.

OWING to the scarcity of lubricating oils during the war and the present high price of castor oil, it was considered possible that the cultivation of castor oil plants, as a source of oil, might prove a remunerative side-line in semi-tropical districts of the State. Investigations were accordingly commenced in 1918 at Grafton and Wollongbar Experiment Farms, and small plots of the Eureka variety were planted.

Owing to excessive rains and subsequently to frosts, the results at Wollongbar were of so little promise that the experiments were not continued beyond the first season, but the trees at Grafton withstood the winter of 1919 very well and made good growth in the spring, yielding seed at the rate of 1,800 lb. per acre. On 21st November, 1919, two more plots were planted (one with Eureka and the other with Queensland Red) and on 13th June, 1920, these plots yielded at the rate of 1,875 lb. and 1,720 lb. per acre respectively. The whole of the plants were cut hard back in August, 1920, and during the spring and summer made vigorous growth. The plots were harvested on 26th April, 1921, and the seed was subsequently husked by being spread in heaps upon tarpaulins and allowed to heat until the seed capsules expelled their contents. Eureka yielded at the rate of 1,110 lb. and Queensland Red at the rate of 800 lb. per acre.

The detailed costs of production per acre last season were as follows:—

	£	s.	d.
Two ploughings at 14s. each	1	8	0
Two harrowings at 3s. 3d.		6	6
Two cultivations (one horse cultivator) at 2s. 11d. ..		5	10
Pruning	1	8	4
Harvesting	1	18	4
Carting and stacking		11	8
Fermenting		14	2
Seed (10 lb.) at 8s. per bushel		2	0
Total	£6	14	10

The seed was disposed of to a Melbourne firm at £14 per ton, and the Eureka variety thus returned approximately £7 per acre and resulted in a loss of a few shillings per acre after freight to Melbourne had been paid. Even with castor oil seed selling at the war rate of £25 per ton the profit from the crop does not compare with that from dairying or from maize, potatoes and other crops suited to the rich lands of our North Coast. The Department is now in possession, however, of information regarding the cultivation, harvesting and general treatment of the crop which may possibly be of some use to intending growers on the poorer land of the North Coast should the price of oil rise to a figure at which the cultivation of the plant in this country would be remunerative. It might be mentioned that the analysis and examination of the seed, by both the Department's chemist and the firm who purchased the seed yielded by the experiments, showed it to be equal in quality to that of the best imported sample.

Farmers' Experiment Plots.

POTATO EXPERIMENTS, 1920–21.

New England District.

M. H. REYNOLDS, Inspector of Agriculture.

THE results from the potato crop in New England for the season just closing has been disappointing to growers both as regards yield and monetary return.

Owing to the scarcity of potatoes for table and seed purposes in the preceding season (when prices ranged to £25 per ton), many persons not regularly engaged in the industry planted potatoes this season, with the result that seed potatoes were in great demand, and the greater portion of the seed planted for this season's crop cost on an average £12 per ton. With the average sowing of 9 cwt., the actual cost for seed per acre ran into £5 8s. The cost of planting and cultivation probably accounted for another £2 5s. per acre. With a yield to the acre of, say, 3½ tons, of fourteen bags to the ton, costing 1s. 3d. per bag to dig, is added £3 1s. per acre. To this has finally to be added cost of delivery at rail, which is about 12s. per ton on an average. Thus it will be seen that the cost of production of potatoes per acre this season has been somewhere about £13 ; which does not include the rental value of the land, so that it would appear that the farmer would require £4 per ton net for all the potatoes dug. Unfortunately, owing to disease and wet conditions, at least one-third of the crop was unsaleable, and with the additional cost of storing and rehandling the saleable potatoes, due to an over-supply, I estimate that quite a number of farmers have had an actual loss of £6 per acre.

Such a result illustrates the advisability of farmers devoting themselves more to mixed farming operations. The tendency to increase the area of any crop which in the season preceding has realised high prices is perhaps a failing world-wide among farmers. It is a weakness which is not unrelated to the farmer's persistent bias in favour of the individual as distinct from the co-operative method of conducting his business. There can be no doubt too, of course, that there is an urgent necessity for finding additional markets or uses for potatoes, for it is quite evident on this season's results that, given an average season, potatoes are over-supplied by the present growers as a raw product. The large area of suitable soils for potatoes still in the virgin condition in this State would very quickly be occupied were the demand for the product greater. One way to increase the demand for locally-grown potatoes is to improve their quality and classification. By aboveboard competition New South Wales growers should secure at least the market in their own State. A very promising movement in this direction is now developing in New England.

Trials (either variety or fertiliser) were conducted during the season 1920-21 in co-operation with the following farmers:—

J. F. Chick, Tenterfield,
J. Piper, junior, Llangothlin,
Hill, Robinson and Butt, Guyra,
O. J. Perry, Armidale,
L. M. Rixon, Uralla,
T. Farlow, Glen Innes,
J. W. Jay, Ben Lomond,
G. D. Moorse, Black Mountain,
Manager, Kentucky Soldiers' Settlement,
W. H. Lye, Tamworth.

In each instance the farmer carried out the plan of operations satisfactorily, and assisted materially in supplying his neighbours with information. At some centres there is a marked interest in the plots. Although, judging from the rainfall records, anybody not conversant with New England soils would consider that there was ample for any crop, from Black Mountain to Glen Innes there was a shortage in the rainfall in January and February, which shortage materially reduced the yield of crops. The long season varieties were most promising until the appearance of blight in the early autumn. This was quickly followed by wet rot, and other fungoid conditions, which, aggravated by excessive rainfall in the late autumn and winter, caused considerable loss and damage.

RESULTS of Variety Trials.

—	Tenterfield.	Llangothlin.	Guyra.	Dumaresque.	Uralla.	Ben Lomond	Kentucky Soldiers' Settlement.	Tamworth.
	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.
Surprise	6 12 0	3 4 2	5 15 0	5 12 1	3 18 3	7 14 0	7 0 0	4 9 0
Carman No. 1 ...	6 14 3	2 12 3	2 15 0	3 7 0	2 8 0	6 13 0	4 13 0	3 18 0
Early Manistee ..	6 12 0	2 7 0	3 10 0	4 9 1	2 5 0	6 1 0	2 14 0	...
Early Manhattan ...	6 10 0	2 9 1	3 5 0	4 0 0	2 3 0	6 13 0	5 3 0	5 0 0
Queen of Valley ...	6 12 0	3 2 1	4 0 0	4 13 3	3 0 0	8 13 3	6 10 0	5 0 0
Brownell's Beauty ..	5 12 3	2 11 3	4 10 0	4 16 2	3 18 0	...	4 15 0	5 11 0
Factor ...	8 5 0	3 1 3	3 15 0	5 4 0	2 18 0	8 9 2	6 3 0	5 0 0
Satisfaction	5 15 0	2 5 3	...	4 10 1	1 19 1	5 11 2	5 1 0	...
Dakota Red	...	2 13 3	4 10 0	...	...	7 1 1	6 0 0	...
Coronation	...	3 7 2	4 12 2	5 5 2	3 19 2	8 6 0	11 3 0	...

Owing to damage caused by wet weather and disease, the results at Red Range were not comparable.

The most prolific varieties of the long season type were Surprise and Coronation, and of the early varieties, Factor, Queen of the Valley, and Coronation produced the most second growth.

RESULTS of Fertiliser Trials.

Fertiliser per acre.	Tenterfield.			Llangothlin.			Guyra.			Armidale.*		
Variety.	Early Manhattan.			Early Manhattan.			Coronation.			Satisfaction.		
	t.	c.	q.	t.	c.	q.	t.	c.	q.	t.	c.	q.
No manure	3	8	0	3	0	1	5	5	0	4	12	3
P9 mixture, 4 cwt.	4	14	0	5	1	1	6	15	0	6	17	3
P7 mixture, 256 lb.	4	12	0	4	10	0	4	10	0	4	15	0
M7 mixture, 368 lb.	4	18	0	3	10	1	5	5	0	4	0	2
Superphosphate, 2 cwt. ..	4	12	0	3	16	1	5	5	0	4	0	0
Superphosphote, 3 cwt. ..	.... ..			3	7	2	5	10	0	4	10	1

Fertiliser per acre.	Uralla.			Kentucky.†			Black Mountain.§			Ben Lomond.		
Variety.	Manhattan.			Coronation.			Manhattan.			Coronation.		
	t.	c.	q.	t.	c.	q.	t.	c.	q.	t.	c.	q.
No manure	2	19	0	11	14	0	4	10	0	8	4	0
P9 mixture, 4 cwt.	4	2	0	12	13	0	3	10	3	12	5	0
P7 mixture, 256 lb.	2	18	0	7	9	0	3	8	3	10	12	0
M7 mixture, 368 lb.	2	19	0	10	2	0	3	11	0	11	4	0
Superphosphate, 2 cwt. ...	2	17	0	10	9	0	3	13	3	10	16	0
Superphosphate, 3 cwt. ...	3	6	2	10	10	0	3	7	2	10	12	0

* Yields not comparable owing to variations in soil.

† The low yields in the P7 and M7 plots were due largely to misses in rows

§ The soil in this plot was a black volcanic loam. The reduced yields from manuring on this soil are attributed to the dry spell in January and February.

The fertiliser mixtures are made up as follows:—P9—10 parts superphosphate, 3 parts chloride of potash, and 3 parts sulphate of ammonia; P7—1 part superphosphate, 1 part bonedust; M7—10 parts superphosphate, 3 parts chloride of potash. The approximate cost (plus freight) of the fertilisers per acre was:—Superphosphate 2 cwt., 13s.; superphosphate, 3 cwt., 19s. 6d.; P9, £2 16s. 4d.; P7, £1 5s. 2d.; M7, £2 1s. 6d. The fertilisers were applied along the rows before the potatoes were dropped in.

P7 mixture generally gave satisfactory results in these trials. The dryness of the season at the critical period caused the manuring to be unprofitable. The yield of the succeeding crop, of whatever kind, on the fertilised area will be noted in order to ascertain whether the residual portion of the fertiliser has any effect.

PERCENTAGE of Seed Potatoes in Fertiliser Trials.

Locality.	No Manure.	P9.	P7.	M7.	2 cwt. Superphosphate.	3 cwt. Superphosphate.
	per cent.	per cent.	per cent.	por cent.	per cent	per cent.
Black Mountain ...	40	45	40	41	37	40
Kentucky	13	15	20	19	20	23

In arriving at the above figures, tubers weighing between 1½ and 4½ oz. were designated seed potatoes, and those weighing less than approximately 1½ oz. were discarded.

PERCENTAGE of Seed Potatoes in Variety Trials.

Variety.	Armidale. (Tubers up to 4½ oz. designated seed).	Uralla (Tubers up to 3 oz. designated seed).	Llangothlin (Tubers up to 3½ oz. designated seed).	Ben Lomond (Tubers up to 3½ oz. designated seed).
	per cent.	per cent.	per cent.	per cent.
Surprise	23	11	34	14
Brownell's Beauty ..	28	11	36	..
Manhattan	50	25	42	18
Early Manistee	54	30	52	...
Satisfaction	56	...	49	...
Queen of the Valley ...	57	28	55	50
Carman No. 1 ..	59	..	47	35
Coronation	61	31	54	...
Factor . .	62	21	48	...
Dakota Red ..	...	...	30	18

RAINFALL Records.

Locality.	Date Potatoes Planted.	Sept. 1920.	Oct. 1920.	Nov. 1920.	Dec. 1920.	Jan. 1921.	Feb. 1921	Mar. 1921.	April, 1921
	1920.	pts.	pts.	pts.	pts.	pts.	pts.	pts.	pts.
Tenterfield	21 Oct.	282	341	206	270	112	290	285	149
Guyra ...	29 Oct.	335	222	326	409	135	265	501	122
Armidale ..	2 Nov.	...	117	279	320	349	295	290	144
Uralla .	4 Nov.	321	300	135	314	350	169	293	155

The outstanding feature of interest in the whole trial were the high yields on Mr. Jay's plot at Ben Lomond. Special mention is made of this plot because I attribute the good results chiefly to the condition of the soil. By the condition of the soil is not meant the cultivation given to it : this, as in the other cases, was satisfactory. The land on which the plot was situated was broken from pasture in August, 1920, and harrowed, ploughed again in September, and harrowed, and the potatoes were ploughed in on 18th November, 1920. The rainfall at this plot was possibly lower than at any other plot, and the soil naturally the richest, and yet greater yields and better results were obtained from the application of manure than elsewhere. I attribute the high yields to the porous condition of the soil, brought about by masses of fine fibrous roots, which were from the native hardy grasses and bracken fern, and were generally of a wiry nature. I consider that a cause of the reduced productivity of potatoes on the New England volcanic soils is due to insufficient porosity in the soil. Experiments in renewing this condition by rotating suitable crops or pastures have promise of interesting results.

Southern District.

G. C. SPARKS, Inspector of Agriculture.

THE 1920-21 potato experiments in the southern district were located as under:—

E. M. Herring, "Sheen," Batlow
A. Pannach & Son, "Mount Excelsior," Lavington.
R. V. Savage, "Glenhope," Tumbarumba.
A. E. M. Hassall, "Brooklyn," Bookham.

At Bookham germination was bad owing to defective seed and dry weather, and yields were not comparable.

The growing season was a very long one, and eminently favourable to late maturing varieties. The copious spring rains of 1920 ensured a moist seedbed, and the crop had an exceptionally good start; but immediately following planting a long practically rainless period was experienced, and it was not until the very end of February that favourable weather again prevailed. By this time the earlier maturing varieties had completed too much of their growth to adequately benefit, and low yields resulted from them in every instance. The late maturers however, made an almost complete recovery, and the cool, moist weather of early autumn, coupled with the absence of early frost, enabled these varieties to make exceptionally strong growth and to produce heavy yields.

Cultural Details.

Batlow:—Basalt, chocolate loam. Ploughed September, harrowed and sown to variety trial 15th December and to fertiliser trial 22nd December. Harrowed again 15th January, scarified and hilled 23rd February. Effective rainfall, 732 points.

Lavington:—Sandy loam, alluvial. Cropped with oats for hay in 1919; ploughed 9 inches deep first week of September, scarified four times, and sown 16th to 18th December. Cross-harrowed when 3 inches high, scarified three times, hilled and scarified again at end of February to break crust following heavy rain. Effective rainfall, 610 points.

Tumbarumba:—Granite, buff-colored loam. Ploughed 4th November, harrowed and sown 21st December. Harrowed; scarified 15th February.

Planting details were identical in these experiments. The rows were 36 inches apart. The sets were ploughed in, dropped by hand 15 to 16 inches apart and manured with 2¼ cwt. of superphosphate per acre.

The outstanding feature of the variety trials was the success of Factor. This was the heaviest yielding variety at Lavington and Tumbarumba, and while at Batlow it gave a comparatively low yield, this was largely due to the fact that the Factor seed, together with the Up-to-date and Carman No. 1 were brought from another district, and were all three very severely damaged in transit, and in bad order at planting. Next season, however, when local seed is again available, it is confidently anticipated that Factor will once more prove itself one of the highest yielding varieties at Batlow and that much better performances will be given by the two other varieties mentioned.

In a season such as the past the advantage lies with very late planting. The wisdom of this course is fully realised, but the difficulty to be overcome is the inability to hold the seed in good order during the hot weather, in spite of the greatest care and most skilful treatment. At Batlow a week elapsed between the plantings of the variety and manurial trials, and upon comparing the corresponding plots in these trials (Coronation manured with 2½ cwt. of superphosphate figured in both experiments), it was found that the late sown had outyielded the other by upwards of 43 cwt. per acre, and it was further observed that the increased yields were secured from bulk sowings made about the New Year.

Crop of Scottish Triumph Potatoes at Lavington, near Albury.

The yield was 13 tons to the acre.

At Lavington, yields touching 13 tons per acre were secured on an effective rainfall of 610 points. It will be observed that here the preparation of the soil was very thorough, and it is quite safe to assert that these results could never have been attained had the cultivation been lacking in any respect. Under normal conditions the southern main potato crop will always have to negotiate hot, rainless periods of long duration during the earlier stages of its growth, which renders it imperative that no effort should be spared to conserve for the use of the crop as much of the previous winter and spring rainfall as possible by early ploughing and by continuous stirring of the surface to check evaporation and to eliminate weeds. At Lavington also, the seed used in the manurial trial was locally grown, and had been produced under a rigorous system of field selection and "trayed" in the most approved style. It was essential, of course, that the variety should have no undue advantage in the variety trial, and a parcel of very good Scottish Triumph seed was secured from the Stanley district of Victoria, along with other varieties. Upon the yields being compared it was found that the local seed had outyielded introduced seed by upwards of 2 tons per acre, viz.:—

	tons.	cwts.	qrs.	lb.
Lavington seed	12	18	3	20
Stanley seed	10	18	0	24

The effects of selection were in this case more than ample to overcome the advantages accruing from the use of seed from a much colder country.

Notes on Some New Varieties.

Batlow Red.—A variety produced by Mr. E. M. Herring. This is a very robust, tall, erect, dark-green variety with oblong, flattened tubers, smooth skinned and shallow-eyed, coloured a "port-wine" red. It is a midseason variety and was the heaviest yielder in the experiment under review.

Batlow X.—Another of Mr. Herring's productions. An early maturing, fairly robust, short, erect growing variety, with foliage of a slightly purplish tint. Tubers are oblong, flattened, shallow-eyed and smooth, flesh tinted with shades of purple, deepening around the eyes. It has proved highly successful at Batlow for early cropping.

Both the above are of excellent table quality.

Scottish Triumph.—A late, purple-flowered, strong-growing variety with flat, round, white tubers, resembling Up-to-date. Grown extensively at Albury.

Carman No. 3.—A late midseason variety with white flat oval tubers, heavy haulm growth and white bloom.

Cooke's Favourite.—A late variety that makes heavy top-growth; white-flowered, tubers white and oval. Apparently withstood more frost than any other variety at Lavington.

Green Mountain.—Resembles Carman No. 1 but with heavier and more erect haulms. Tubers flat and round.

RESULTS of Variety Trials.

Variety.	Batlow.				Lavington.				Tumbarumba.			
	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.
Batlow Red	8	14	1	23		....				....		
Batlow X ...	4	12	0	19		....				....		
Brownell's Beauty...	8	11	0	18		....				....		
Carman No. 1 ...	4	8	3	14	9	6	1	6	3	12	2	20
Carman No. 3 ...	6	1	0	0	9	16	1	20	5	3	0	4
Cooke's Favourite ...	4	17	2	0	10	6	1	20		....		
Coronation	7	11	1	19		....				....		
Early Manistee ...		....			7	3	3	0		....		
Factor	6	18	0	28	12	13	0	24	9	5	1	0
Green Mountain ...		....			8	19	0	20		....		
Satisfaction... ...		....			5	9	3	0		....		
Scottish Triumph ...	5	12	0	2	10	18	0	24	8	17	2	18
Up-to-date	4	12	0	19	12	3	0	4	6	17	1	20

Manurial trials were carried out at Batlow and Lavington. At Lavington the response to the various manures was comparatively slight, which was probably due to the fact that the manured plots completed relatively more of their growth than the unmanured before the break in the weather and therefore were somewhat severely handicapped. At Batlow, however, with cooler climatic conditions and slightly more rain the increases were very heavy.

The 2½ cwt. superphosphate dressing was the most successful of the manures, outyielding the 5 cwt. application in both experiments. The various mixed fertilisers, while more costly than the 2½ cwt. of superphosphate, failed upon this occasion to give increases of yield sufficient to justify their recommendation.

RESULTS of Fertiliser Trials.

Fertiliser per Acre.*	Batlow. (Coronation.)				Lavington. (Scottish Triumph.)			
	t.	c.	q.	lb	t.	c.	q.	lb.
No manure	4	5	2	9	12	0	2	24
Superphosphate, 2½ cwt.	9	14	0	23	12	18	3	20
" 5 " ...	9	4	3	28	12	10	2	24
M7, 3¼ cwt.	8	14	1	24	13	0	0	0
P7, 2¼ "	6	3	0	18	12	1	2	12
P9, 4 "	7	8	0	14	12	18	0	4

* The composition of the fertiliser mixtures was as follows:—M7, 10 parts superphosphate and 3 parts chloride of potash; P7, equal parts bonedust and superphosphate; P9, 10 parts superphosphate, 3 parts chloride of potash, and 3 parts sulphate of ammonia.

Southern Tablelands.

R. N. MAKIN, Inspector of Agriculture.

DURING the season 1920-21 two potato experiment plots were sown on the Southern Tablelands, both in the well-known Cotta Walla district near Crookwell. Much interest was evinced in the trials of the different varieties by growers in the locality.

The soil on which the plots were established is of basalt formation, red in colour, well drained and carrying a clay subsoil. Messrs. Howard Bros'. plot was on land that had not been cropped for some time. The crop received careful attention and the good returns are largely due to the interest displayed by the owners. Mr. Lund's plot was situated on ground which proved somewhat drier than the other, and, owing to being on a newly purchased property, its owner was not able to give it the attention he wished. The potatoes, in each plot, were ploughed in and manured with 2 cwt. superphosphate per acre, planting taking place in November and harvesting in June and July. No disease of any consequence affected the plots.

In glancing at the returns it will be seen that in each case Factor and Magnum Bonum yielded well ahead of other varieties. Both are white-skinned varieties and suit the district well. Factor will be largely planted this season as it has become very popular. Magnum Bonum has been grown for many years in the Crookwell district and although very late in maturing it can be relied upon to yield well in most seasons. It is sold on the Sydney market under the name of Snowflake.

Of the other varieties under test Up-to-date and Manistee proved their worth. The former is well known and liked in some parts of the district, while Manistee (the earliest of the varieties tested) is attracting attention on account of its quality and earliness. Tasma—the new variety from Tasmania—was very disappointing. Perhaps when larger supplies of seed are obtainable and it becomes acclimatised, better results may be forthcoming—the plots sown were rather small for comparison. The yields were as follows:—

RESULTS of Variety Trials.

Variety.	Howard Bros., Cotta Walla.				S. H. Lund, Cotta Walla.			
	t.	c.	q.	lb.	t.	c.	q.	lb.
Carman No. 1	4	19	2	12	1	15	1	12
Up-to-date	6	13	1	2	2	6	1	8
Factor	9	15	2	3	3	0	0	11
Satisfaction	5	6	1	17	1	9	0	16
Manistee	5	19	0	0	2	5	2	19
Magnum Bonum	9	4	0	13	4	3	2	21
Tasma	3	15	1	27	0	19	3	14

KIKUYU GRASS (*Pennisetum clandestinum*) IN QUEENSLAND.

IN April of this year some roots of kikuyu grass were forwarded to Mr. J. C. Pryce, Toogoolawah, Queensland. Mr. Pryce had seen the grass growing in the Department's grass and fodder plant plot at the last Royal Agricultural Society's Show, and was greatly impressed with its value as a pasture grass.

His report is now to hand and is as follows:—

> The roots of kikuyu grass were planted out 4 feet apart each way in the field, in fair loamy soil, with clay subsoil. In a month's time the whole of the ground between the plants was covered, and the grass was about 10 inches high. I cut it regularly every month during the winter, and have continued to do so since.
>
> It is by far and away the best grass I have tried here, and appears to suit the soil and climate of this district. It is my intention to continue planting as roots become available. Stock are very partial to the grass, and I am more than pleased with the result. So far the grass has not seeded, and does not appear to run to seed.

Although kikuyu grass has done well during the winter in Queensland, it must be kept in mind that in districts where heavy frosts are experienced the grass is cut back to some extent, but it rapidly makes headway when the winter is over. Where the winters are mild the grass keeps fairly green and makes some growth.

Up to the present time kikuyu grass has not shown any signs of forming seed-heads in this State.—J. N. WHITTET, Assistant Agrostologist.

Destruction of Rabbits by Motor Car Fumes.

MAX HENRY, M.R.C.V.S., B.V.Sc., and C. J. WOOLLETT, Stock Inspector.

THE first experiments by the Department in the destruction of rabbits by the fumes from a motor car exhaust were those carried out at the commencement of last year by Mr. A. H. E. McDonald, Chief Inspector of Agriculture, and one of ourselves (M.H.). The number of rabbits killed in that preliminary experiment was very small, but this was due to the fact that no more were present in the burrows operated on, rabbits not constituting a particular pest at that time, and the results were considered sufficiently encouraging to warrant further trials.

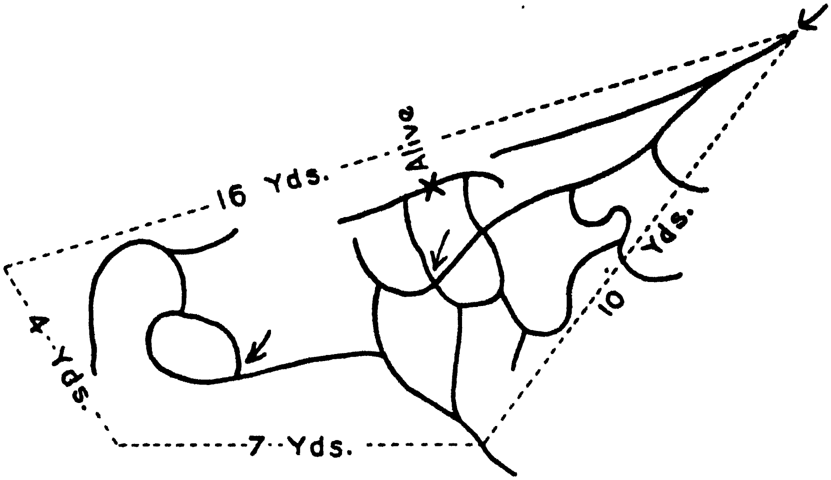

Fig. 1.—Rough plan of a rabbit warren that was fumigated with motor car fumes.
The fumes were forced in at the points indicated by arrows.

The method employed in both the initial and subsequent experiments was to attach an ordinary rubber hose to the exhaust pipe of the car and to pass several feet of the hose into the main entrance of the burrow to be treated. The engine was then started, and as smoke appeared from other entrances to the burrow these were blocked up. It was found afterwards that the heat burns the rubber of the hose, and in later trials a galvanised iron funnel, 30 inches long, was made, and attached to the exhaust pipe. The engine should be run slowly, not raced.

In the first series of experiments it was found that the fumes would kill the rabbits if pumped in for half to three quarters of an hour, and that it was not advisable to open up the burrows immediately after fumigating. One of the burrows fumigated in these early trials was a large one in sandy soil near the bed of a creek. The engine was run for half an hour, consuming slightly over half a gallon of petrol. In another case the burrow was a small one in black soil, and the engine was run for twenty-five minutes, 1½ pints of petrol being used. The burrows were subsequently dug out, and rabbits were found dead in parts as far as 28 feet from the entrance into which the fumes had been forced.

Post-mortem examinations of the rabbits indicated that death was due to asphyxia, following the inhalation of the fumes, the lungs and blood generally showing the peculiar bright red colour indicative of carbon monoxide poisoning.

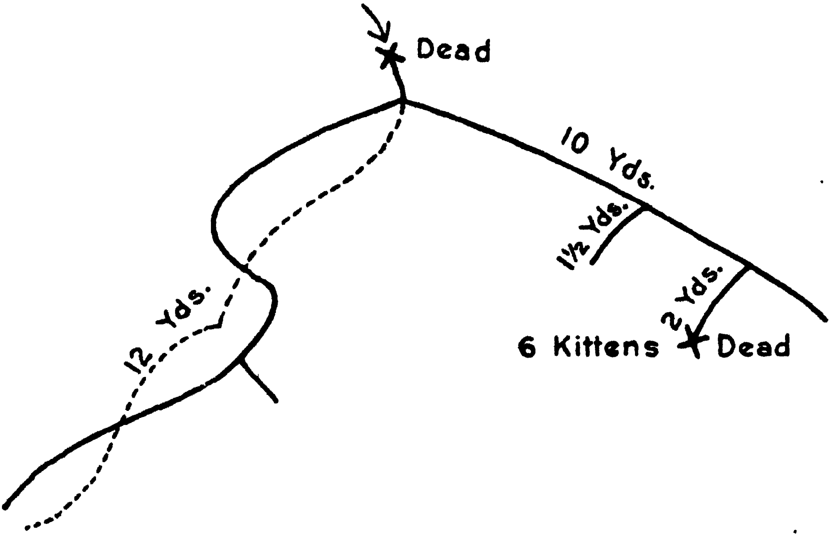

Fig 2.—Plan of a less complicated warren that was fumigated with motor car fumes.
It was thought this and the warren in Fig. 1 were connected, but this proved not to be the case. Over 100 dead rabbits were taken from the two systems.

The second series of experiments was conducted by ourselves, and in these the above findings were confirmed, but we found it possible to reduce the period of fumigation to ten minutes. The same method was used in subsequent trials, from which the following results have been obtained :—

Warren.	Period of Fumigation.	Number of rabbits found.
No. 1 ...	5 minutes	Seventeen dead, and two (about a week old) just alive.
No. 2 ...	5 „ ...	Ten dead.
No. 3 ...	10 „ ...	Ten dead and one alive.
No. 4 ...	5 „ ...	Nest of three kittens (about fourteen days' old) just alive.
No. 5 ...	10 „ ...	Eight dead.
No. 6 ...	10 „ ...	Three dead.
Nos. 7 & 8	Two warrens done together. Fumes pumped in at several places for half an hour altogether. From these warrens 100 dead and one live rabbit were removed.	

The warrens Nos. 7 and 8, mentioned in the table, are the two illustrated in the accompanying diagrams. Two extensive systems were thus fumigated and 100 rabbits killed at the cost of running a car engine for half an hour. The farmer, of course, would not require to dig out, except to satisfy his own curiosity. Where the rabbits are numerous, and even where the burrows are fairly large, destruction by this means seems to be practicable and economically sound, for the cost of the petrol consumed by the running of the engine would be small compared with the value of the work done.

RATE-OF-SEEDING EXPERIMENT WITH MAIZE.

In the drier districts of America (those with a rainfall of less than 30 inches) considerable success has been reported with maize planted in widely spaced rows, and it has been claimed that from rows 7 or 8 feet apart a yield of 15 to 20 bushels per acre is obtainable in a dry season, as compared with only 2 or 3 bushels, or a total failure, from rows planted the usual distance, 4 feet apart, and that in a good season the difference between the two methods is almost negligible. It is argued that with wide spacing moisture can be conserved for the cobbing period by intercultivation, because the roots do not extend to the middles until near that stage, whereas with the ordinary distance between the rows the soil moisture is drawn upon for the making of vegetative growth, leaving none for the cobbing stage—the effect being all the more harmful if a dry spell occurs during cobbing.

In view of such reports it was decided last season to institute experiments at Bathurst Experiment Farm, which is situated in a district where the rainfall is uncertain and where the maize is usually planted in rows 5 feet apart, in single grains at a distance of 20 inches. The rates of seeding and resulting yields were as follows :—

Rate of Seeding.	Yield per acre based on Percentage Yield.	
	bus.	lb.
*Rows 8 feet apart, single grains every 12 inches apart in the rows	25	14
Rows 8 feet apart, three grains every 5 feet apart in the rows	24	23
Rows 8 feet apart, single grains every 20 inches apart in the rows	22	44
Rows 5 feet apart, single grains every 20 inches apart in the rows (average of check plots)	33	6

* This rate of seeding gives approximately the same number of plants per acre as that used on the check plots.

It will be seen that the wider sowing proved a disavantage last season. The weather was wet (1,681 points of rain falling during the growing period), and summer crops were above the average in yield. No conclusions can be drawn at this stage of the experiment.—L. F. ROWNEY, Experimentalist.

Cheesemaking on the Farm.

[Continued from Vol. XXXII, page 890.]

J. G. McMILLAN, M.B.D.F.A., N.D.D.

Hooping, or Moulding.

SALTING being completed, the next process is hooping or moulding. This is done to press the cheese into a shape suitable for transport purposes and to a certain extent to preserve the curd to allow of proper ripening. There are a number of kinds of hoops, but that in general use is the "Wilson," a telescopic one. The hoop is prepared for the reception of the curd in the following manner. The bottom lid is laid on a table, and into it is placed a circular piece of hessian the diameter of which is slightly less than that of the lid. Into the lid is then placed the expanding band, and the cheese bandage, which is tubular in form, is fixed on the inside of this band, spreading about 1½ inches around the bottom and top. A circle of stiff muslin is put inside, the outer cylinder is fitted on top of the cloth and held in position by two clips, and the curd is filled into the hoop, care being taken to press it well, particularly round the sides. The hoops should be placed on the scales and exactly the same amount of curd should be put into each. Another muslin circle is placed on top of the curd and over that a hessian circle similar to that placed in the bottom. Finally, the top lid is put on, and the hoop is ready to put in the press.

The temperature of the curd at hooping should be about 85 deg. Fah. If it is too warm fat will be unduly pressed out, while if too cold it will be difficult to get the particles to knit together. Never, if it can be avoided, keep any curd over until the following day, but rather make a smaller cheese if there is insufficient to make a large one. For this reason it is advisable always to have a 3-lb. and a 5-lb. hoop. Always aim at having the various sizes of cheese of even weights, for not only do such cheeses look better, but buyers for the export trade are often prepared to pay a higher price because of the easier packing of even-sized cheese. A 40-lb. hoop with curd should weigh about 54 lb., and a 10-lb. hoop 17½ lb. before pressing; this will give a band on the cheese about ¾ of an inch wide.

After putting the cheese in the press apply a medium pressure for fifteen minutes, after which full pressure may be applied. If pressure is applied too rapidly a rind is liable to be formed which prevents the whey escaping from the centre. After an hour the pressure should be released and the hoops taken out. The top lid is removed, then the outer cylinder, and the cloth is pulled up over the end. The cloths should be neatly trimmed at both ends, leaving little more than an inch over at either end; this presses into the cheese easily, giving it a nicely finished appearance. The hoops are again put in the press (it is advisable to have a table fitted with castors for placing the hoops on) and full pressure is applied. The hoops should now be allowed to stay in the press for twenty hours, and when there are enough hoops and there is sufficient space in the press-room, thirty-six hours will be beneficial. The morning after making it is a good thing to take the cheese out of the hoops, place it in a bath of water at 120 degrees Fah. for one minute and replace it in the moulds and subject to further pressure. This washes out any fat that may have collected between the particles of curd on the outer surface of the cheese, and the removal of this fat allows of a better rind on the finished cheese. Great difficulty will be experienced in getting a good rind on the cheese at times. In addition to bathing, some makers put on a double bandage, the outside one being removed when the cheese is taken out of the press; this bandage can be washed and used for a considerable time.

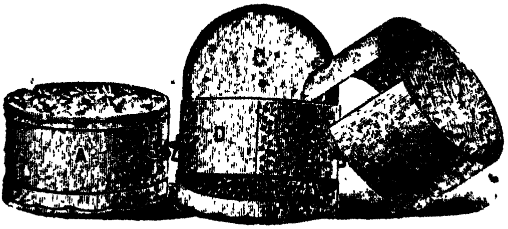

Fig. 21.—Curd Hoop.

A. Hoop fully assembled. B. Bottom lid with widest flange or rim. C. Top lid. D. The outer cylinder. E. Expanding band.

(*After Decker.*)

There are various kinds of presses on the market, of both vertical and horizontal types. The latter kind is in general use, but if a vertical lever press can be obtained for a farm dairy it is better as it takes up less room, though the pattern of the press is not otherwise of much moment.

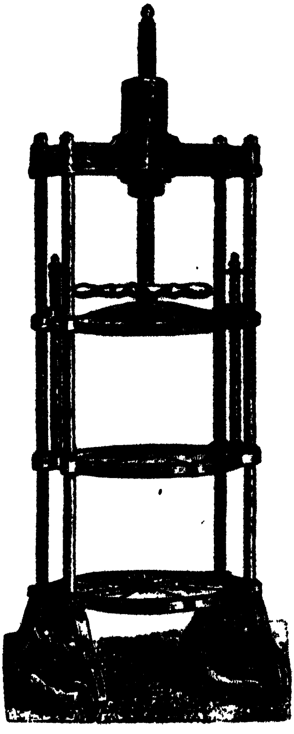

Fig. 22.—Vertical double-lever press.

(*After Tisdale and Woodnutt.*)

Curing.

After the cheeses have been sufficiently pressed they are taken out of the mould, the hessian circles removed, and the date of making stamped on each cheese. They are then taken to the curing room, placed on shelves and turned daily for at least three weeks, when turning every alternate day will do. The curing room should not be allowed to get to such a temperature that the cheese will sweat. If it can be possibly managed, never let the temperature rise above 65 degrees Fah. At the end of three to four months the cheese should be properly matured. The demand is for cheese about a month old, and, although this is unfortunate in the interests of cheese of proper maturity, it is to the advantage of the maker insofar that the longer the cheese is kept the lighter in weight it becomes, owing to loss in its moisture content. When sending cheeses any distance by boat or rail it is always advisable to crate them to prevent damage, but when they are delivered to the agent or retailer by the owner packing is not required. Before sending it away the cheese should always be weighed and odd ones tested to give the maker an idea of the class of product he is making. He must then refer to the chart that he should have in daily use, and if anything abnormal is discovered the chart should show where any error in manufacture has occurred. This assists the cheesemaker in becoming a good grader. A suitable chart is shown on page 42.

Absolute Cleanliness Necessary.

Cleanliness in the factory is just as important an essential in the production of good cheese as it is in the production of satisfactory milk. A clean factory, too, may be an important agent in selling your cheese; have the factory so conducted, therefore, that the most fastidious visitor could pass only favourable comment. It is advisable to wash every utensil as soon as possible after use. To wash the making vat always have a bucket of whey and scrub it thoroughly with this—it will remove particles of curd more readily than water. The second washing should be done with tepid water, and the final one with boiling water containing soda. After this water is properly drained off put all the smaller utensils (rake, knives, &c.) in the vat, put the cover on, insert a hose connected with a steam pipe and give a thorough steaming for about two minutes, making sure that there is no water in the jacket of the vat. Then remove the covering quickly and allow the steam to escape. Do not dry the vat, as the heat generated by the steam should be sufficient

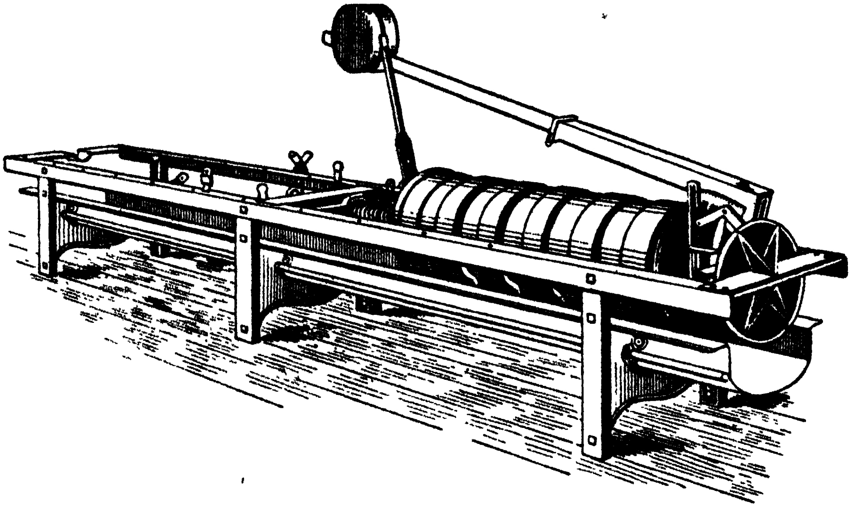

Fig. 28.—Horizontal continuous press.

SCHEME FOR CHEESEMAKING CHART.

	Sun.	Mon.	Tues.	Wed.	Thurs.	Fri.	Sat.
Date of making							
Quantity of milk (lb.)							
Quantity of starter (lb.)							
Acid in starter							
Time starter added							
Amount of colour (drms.)							
Amount of rennet (oz.)							
Acidity of milk (per cent.)							
Rennet test (seconds)							
Time of renneting							
Temperature (deg. Fah.)							
Time to catch (minutes)							
Time curd cut							
Acid in whey at cutting							
Time heating started							
Time heating finished							
Temperature heated to (deg. Fah.) ...							
Time whey drawn							
Acidity in whey and iron test... ...							
Condition of curd							
Time from renneting to wheying off ...							
How cheddared							
Time curd milled							
Time curd salted							
Amount of salt							
Temperature of curd							
Time hooped							
Number of cheeses and sizes							
General remarks							

to dry up all moisture. Always be sure that the tap is thoroughly cleaned daily, as there is danger of curd collecting in it, proving a source of contamination. After being steamed, the small utensils may be hung up. A piece of open muslin or mosquito net should be placed over the vat to keep out dust and flies, and the outside should be washed daily to prevent accumulation of organic matter, and any brass on the vat or in any part of the factory should be kept well polished.

Hoops must be washed daily, also the hessian circles. Some makers only wash them occasionally, and the result is the growth of yeasts, one of the greatest troubles that can arise in a factory. All cloths used in connection with the work should be thoroughly washed with soap, boiled, and hung out in the sun to dry. Avoid letting whey get on to the floor, as it eats away the cement. Floors should be thoroughly washed with boiling water daily and kept as dry as possible. The washing of the walls with lime cannot be too frequent; the ceilings should be painted white preferably. After the cheese has been removed the shelves should be thoroughly washed and put out in the sun to dry. Dirty shelving assists in breeding mites and moulds. Mites destroy cheese, and some of the moulds are injurious even if there are no cracks in the cheese.

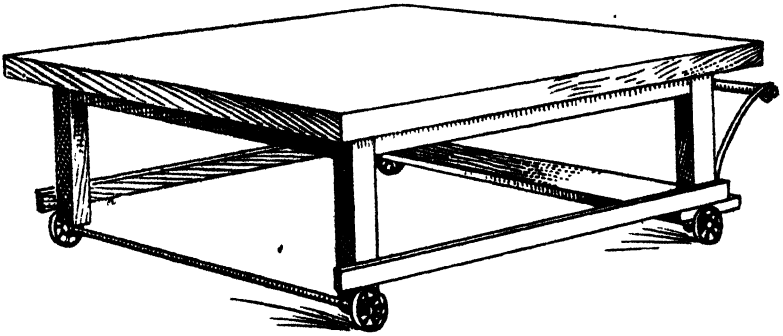

Fig. 24.—Cheese table on castors.

Suitable for dressing and taking cheese out of hoops; made of fairly stout timber, top being at least 1½ inches in thickness; surface should be water-tight

The Perfect Cheese.

When a plug is taken out of a first-class cheddar cheese it should be perfectly solid and free from holes. When the plug is broken the break should be like a piece of broken stone and not granular—that is, exactly the opposite to a break in butter. A piece of the plug when passed between the index finger and thumb should not be soft, but firm and velvety.

The colour is judged by the appearance of the plug when first drawn. This is held up between the eye and light, when it should show a semi-transparency, showing no streakiness, dullness, spots, or irregularity. The flavour of a cheese is recognised by the aroma when a piece is pressed in the palm of the hand. This method has to be adopted when a number of cheeses are being judged or graded; if a grader tasted every cheese he tried there would soon be confusion. However, for the maker on a small scale the tasting of the cheese will give him a good idea of what his product is like. The flavour should be perfectly clean (sometimes called "nutty") and free from any objectionable smells. The cheese should be of a good shape and fairly straight on the sides, the ends should be neither too flat nor bulged when the level is taken with the eye, the centre being about the thickness of a penny higher than the edges. When pressed with the hand there should be a certain amount of give—neither too much nor too little.

Fig. 25.—A close textured cheddar cheese.

Fig. 26.—A loose-textured cheddar cheese.

Common Defects in Cheese.

Sour Flavour.—This means a sour taste when the cheese is fresh, owing to the presence of too much whey. The causes of such a flavour are several. It may be due to over-development of acid in the milk during the process of manufacture, the use of too much starter, or failure to firm the curd sufficiently before removing the whey.

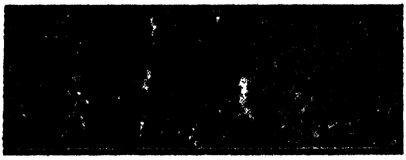

Fig. 27.—Typical texture of sweet curd cheese.

Fig 28.—Effects of gassy fermentation in cheese.

Off Flavours.—These are flavours that are not clean and are due to the presence of undesirable bacteria which gain entrance to the milk or curd. When the cheese ripens properly the odour will be offensive. Careless milking, exposing the milk after milking to an impure atmosphere, using dirty utensils, bad flavoured starters, impure water, bad rennet, &c., are the causes.

Food Flavours.—These are caused by feeding rank food to the cows (though it is not always easy to prevent cows having access to strong flavoured foods), or storing milk near to where any of these foods are kept. When foods that give a strong flavour have to be used, always feed after milking, aerate the milk and use a good starter.

Fruity Flavours.—These are sweet and sickly flavours, having an odour like pineapple, pear, and certain other fruits. They are caused by the presence of yeasts, mainly, and certain bacteria. Putting milk in cans that have contained whey, the too close proximity of pig-sties to where whey is kept, and the imperfect washing of cloths used in connection with pressing are the indirect causes. The cleaning of all whey receptacles and cloths daily and the development of a little more acid in the curd before removing the whey will assist in checking this fault.

Defects in Body and Texture.

Fig. 29.—Effects of improper pressing and seamy colour.

Dry Body.—This is caused by using milk that is poor in fat or milk that has had a portion of its fat extracted, by heating too high in the whey, heating too long, stirring the curd too much at the time the whey is removed, and using too much salt. When such trouble arises pile the curd deeper and allow it to mellow well after milling, and do not heat to such a high temperature in the cooking process.

Acid Body.—This is often confused with a dry body. On looking at the plug of a dry body cheese the colour will be clear, whereas that from an acid cheese will have a bleached colour and the taste will be sour. The causes are too much acid in the milk before renneting, and too much acid in the curd before it is sufficiently cooked.

Open Texture.—Open textured cheese is cheese that is full of holes and it is generally soft in body. It is brought about by too little acid being developed and the retention of too much whey, putting curd to press at too high a temperature, insufficient pressing, and a too high temperature after the pressing process. Open texture is different to a gassy curd texture, in that it contains myriads of holes the size of pin-heads. Gassy curd textured cheese will have a bad flavour, whereas the other may not. The cause of pin-holey cheese is the use of milk infected by gas-producing bacteria and bad starters. The remedy in such a case is to practice scrupulous cleanliness in all operations.

Defects in Colour.

Acid Cut Colour.—This is due to the development of too much acid in the curd before it is properly cooked. A well-cooked curd will always have a good colour.

Mottled Colour.—Caused by an uneven development of acid and moisture in the curd, irregular cutting, adding starter that is lumpy, improper mixing of colour with the milk, uneven piling and maturing of the curd and the use of poor cheese colour.

Seamy Colour.—In this case the surface of the cheese when cut will show the outline of each particle of curd. Greasy curds will cause this by preventing the particles from knitting together in pressing and not allowing the proper absorption of the salt. Impure salt will also cause this fault.

Defects in Finish.

Cracked Rinds.—Cracked rinds may be due to too much acid, greasy curd, insufficient pressing, &c. The remedy is to bath the cheese in water at 120 deg. Fah. the morning after manufacture and put it back in the press. Avoid having over-acid milk.

Mouldy Appearance.—This explains itself. As long as the rind of cheese is free from cracks the ordinary blue mould will do no harm, except that it will give the cheese a dirty appearance; but there are certain moulds which will grow on the ends and impart a bad flavour through the entire cheese. Ensure good circulation in the curing-room; avoid excessive humidity and keep the curing-room clean.

(*To be continued.*)

REMOVAL OF TUBERCULOUS GLANDS.

THE practice is fairly common in some districts of removing by surgical operation certain superficial lymphatic glands in cattle when they become enlarged as a result of tuberculosis, and afterwards selling the animals as healthy. The practice can only be condemned as dangerous and dishonest. In far the greater number of cases the enlarged gland so removed is not the only one affected, others deeper seated but unobservable being implicated, so that sooner or later further signs of tuberculosis may develop.

Such an animal in a herd is a danger to the health of the other animals, and it is particularly unfair to an innocent purchaser because there is no possibility of knowing when it may become infective to other cattle.

There are, of course, many enlargements of the head and neck which are frequently mistaken for tuberculosis, and surgical removal is not only justifiable in many such cases, but the correct procedure. Indeed, were veterinary advice obtainable quite a number of animals destroyed might reasonably be saved, but the tubercular animals that are subjected to surgical treatment as mentioned should be otherwise dealt with in the interests of other cattle, and, perhaps, also, in certain cases, of human life.—S. T. D. SYMONS, M.R.C.V.S., Chief Inspector of Stock.

Reconstructing Milk and Cream.*

L. T. MacINNES, Dairy Expert.

In many centres, especially in the Pacific Islands and in those interior and far northern towns of Australia where dairy herds do not exist and where the residents rely on tinned milk in place of the normal milk of a cow for their supplies, it would be a great boon if milk could be reconstructed from its total solids to resemble whole milk in every way, and without losing its nutritive value for adults and children. The subject is also one of considerable interest to such cities as Sydney, where of late years a considerable shortage in the milk supply has occurred each winter. Up to the present we have always had a large surplus during the summer season, but it has not been practicable to keep it in cold storage for winter requirements on account of its bulk. It is, therefore, evident how important is the assertion that the solids of milk in the shape of unsalted butter and skim milk powder added to water in proper proportions, could be treated to reconstruct a milk that would by chemical analysis be indeterminable from the normal milk of a cow, and judging by bacterial count be many times purer.

Imagine sending a box of choicest butter and a proportionate weight of skim milk powder to, say, Port Darwin or Bourke, where they could be added to a certain quantity of the local water supply, and by a simple process be reconstructed into whole milk again. This was what the representative of the patent confidently asserted was a practical success from a commercial viewpoint.

In order to test the truth of this statement a demonstration was given by him on reconstructing milk and cream. The plant consisted of:—

(*a*) A jacketed mixing tank, capacity 40 gallons. This was fitted with a vertical spindle, to which was attached two propeller blades. On the inside of the tank were two baffle plates or flanges to break the swirl of the contents when the vat revolved; the propellers were for mixing.

(*b*) A cooling tank (containing ice, water, and salt), to which was attached a circulating pump to circulate the brine through the cooler (*d*).

(*c*) A centrifugal machine on the principle of the Sharples separator, the bowl of which revolved at the rate of 22,000 revolutions a minute, and exerted a pressure of 80 lb. to the inch against the inner walls of the bowl. The top end of this bowl was perforated with small holes. The mixture under such great pressure and speed had its solids, both fat and S.N.F., broken up into small particles. This machine also acted as a filter, sedimentary matter, &c., adhering to the sides or inner walls of the bowl.

(*d*) A cooler over which the milk or cream ran as it came from the bowl.

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*Paper read at the N.S.W. Co-operative Butter Factory Managers and Secretaries' Association's Conference, Sydney, 1921.

The Process of Reconstructing Cream.

Town water was put into the jacketed vat mixing tank and heated to 100 degrees Fah. This heating is usually done in a properly-fitted-up plant by a steam coil, but in this instance a gas jet was used. As soon as a temperature of 100 degrees was reached, skim milk powder made under the spray process was added to the water, and while being mixed the heat was raised to 145 degrees. Unsalted butter of choicest quality was then added and the mixer was run at 180 revolutions to the minute. As soon as the mixture reached 180 degrees Fah., which with a steam coil for heating purposes would take about an hour, it was run into the emulsifying bowl, and from there over the cooler, and was chilled down to about 35 to 40 degrees. The mixture was held for some thirty minutes at temperatures varying between 140 and 180 degrees in a closed-in metal tank, being agitated all the time by metal propellers. This ensured thorough pasteurisation, but at the same time it gave a pronounced cooked and metallic flavour to the cream.

Samples were taken of the reconstructed cream as it came from the cooler, and these samples were subjected to analyses and bacteriological examinations and other trials. Two samples of the cream were held in the Dairy Branch—one in the ice-chest and the other at ordinary temperature. In forty-eight hours the latter had developed a pronounced unclean, butyric taste; that in the ice-chest at the same time showed pronounced cooked and slight metallic flavour. Portion of the cream was added to hot tea and immediately dissolved into a liquid oil. The cream from the ice-chest, after being stored for twenty-four hours, was also tried on cooled and semi-cooled dessert, such as stewed fruit and pudding, and used in that manner was palatable and gave a satisfactory result. It is also considered that it could be used with satisfaction as to palatability for the making of ice-cream. The sample held in the ice-chest was again examined on the 29th, or four days after being taken. The surface cream had developed a strong tallowy unclean taste with tendency to butyric, but underneath the surface the flavour had greatly improved. The development of acid had taken away the metallic taste. It was equal to good first quality as judged for butter-making.

After being kept for several days the mixture retained the normal appearance of a 40 per cent. butter-fat pasteurised cream, the constituent parts of which showed no signs of separating or precipitation.

The Process of Reconstructing Milk.

In the afternoon further quantities of town water, skim milk powder, and butter, were taken to reconstruct a milk containing 4 per cent. butter-fat. Samples of this were also taken for chemical analysis, bacteriological examinations, and general observation. Two samples were kept at the Dairy Branch—one at ordinary room temperature and the other in the ice-chest. The former thickened and developed a sour, gassy, butyric smell and taste in twenty-four hours; the latter at the end of the same time was still sweet. On the latter, cream had risen as might be expected on ordinary boiled milk. A sample of this milk which had been freed from the larger particles of cream was added to hot tea, and blended with it in a manner similar to normal milk as drawn from a cow. The flavour of this milk was somewhat similar to that of concentrated milk; it had a distinctly cooked or process flavour and smell, and this was also noticeable in the tea to which it had been added. After standing some time both under ordinary room temperature and in the ice chest, cream rose to the surface of the milk, and after twenty-four hours this became thick, and later on being shaken formed big clots, which were hard to dissolve. After four days in the ice-chest this milk became sour to the verge of coagulating.

The bottles in which these samples were taken were not sterilised, but were simply rinsed out with cold water from the town supply. This would account in part for the milk going off, as to a certain extent it would thus have been infected with injurious organisms. Later samples were taken in sterilised bottles, and the Government Biologist's report is referred to at the end of this article.

Milk made under this process should be much cleaner from a bacteriological point of view than that ordinarily supplied to consumers, and for consumption by adults it is thought it could be used satisfactorily as long as the process flavour was not objected to. It should not be sold as normal milk drawn from a cow, however, but should have some distinct name. Such a milk would probably in one way (by having its solids broken up) be more digestible than normal milk, and hence be more fit for use by children. On the other hand, the prolonged pasteurisation at a high temperature would certainly make it less digestible, according to the opinion held by many scientists on the value of pasteurised and boiled milk as a human food. These and other scientific aspects of the manufacture of such reconstructed milk formed the subject of inquiry by the Department's Chemist and Biologist.

It is considered that much of the process aroma and flavour in both milk and cream would be eliminated if the heating of the mixture in the tank was carried out under modified conditions, such as:—

1. Greatly accelerating the heating process (in the test under review a small gas jet was used to furnish heat).
2. The final temperature to be less than 180 degrees Fah. The fat of butter will melt at a much lower temperature than this, viz., 92 to 98 degrees Fah. It has been shown that by pasteurising cream at 145 degrees for twenty minutes by the holding system, which is somewhat similar to that used in the Sharples process, the bacteriological count has been reduced from 150,997,000 colonies per c.c. in a 1 to 1,000 dilution to 500 per c.c. in a 1 to 10 dilution, so that by heating to something considerably lower than 180 degrees Fah. in emulsifying milk or cream, the purity of the finished article would not be greatly impaired.
3. Arranging the cover of the mixer to allow the steam and gas generated to escape more readily.

4. Using tough-seasoned wood instead of metal for the mixing blades and flanges attached to the inner walls of the mixing vat. This would tend to lessen the metallic flavour generated in the processed milk and cream, especially the latter.

Should these slight alterations effect an improvement, as anticipated, in the flavour of either the milk or cream made, it should add a lot to its attractiveness from a palatability point of view. The nearer the reconstructed article can come in flavour and smell, as well as general appearance to normal milk, the better will be the chance of successfully marketing it with the general public. The danger of developing butyric acid is also to be guarded against.

The fact that the butter added in the mixing machine was melted and held for so long a time at such high temperatures, undoubtedly adversely affected the butter fat by splitting it up. This resulted in the after-development of tallowiness, rancidity, and butyric ferment. Butter-fat only too readily lends itself to chemical changes upon exposure to heat, light, or air. This is why milk powder made from whole milk will not keep under ordinary conditions, but rapidly deteriorates and becomes rancid, unless it is stored away from light under cool conditions. This doubtless explains why in the samples of reconstructed milk and cream taken for examination, those kept in the ice-chest showed such better results from a quality-keeping viewpoint and did not so readily deteriorate.

On 3rd November an additional sample of cream was taken for observation. The flavour showed an improvement. Roughly, 50 lb. of cream was made, taking 21 lb. butter, 3 lb. skim milk powder, 26 lb. water. This would give a cream containing 35 per cent. of fat, allowing that the butter originally contained 16 per cent. of water. The mixing process on this occasion was accelerated and the maximum temperature reached was 170 degrees Fah. The cooked flavour in the cream was considerably lessened and the metallic flavour was absent. Tried on table dessert it was found to be excellent in flavour.

Graded on 4th November, 4 p.m., the flavour of this cream was still good, but at 9 a.m. on 5th November, it was slightly off—a trace of tallowiness and butyric.

A sample of cream made on 2nd November by the afternoon of the 4th, although kept in the ice-chest, had developed a rancid flavour and smell was slightly pungent. Examined again at 9 a.m. on 5th November it was found to be strongly rancid and butyric in both flavour and smell.

The Commercial Prospects.

Anyone considering the manufacture of whole milk or cream by this process would naturally, especially if the product was to be sold, inquire into the cost of production as a matter of prime importance, and compare it with the price that is obtainable on the market in competition with normal whole milk or cream obtained therefrom.

The cost of making milk with a fat content of 3·4 per cent., which is the standard aimed at in supplying consumers, although the legal standard is 3·2 per cent., is as follows:—

Take 100 lb. milk to equal 10 gallons. The amounts of unsalted butter. skim milk powder, and water required to make this quantity of milk are:—

			s.	d.
Butter	3·75 lb.	at 1s. 9d. per lb.	6	6¾
Powder	8·75 ,,	,, 1s. ,, ...	8	9
Water	87·50 ,,	nil.		
	100·0 lb.		15	3¾

This is equal to about 1s. 6½d. per gallon for materials, without taking into account the cost of manufacture, which must be considerable. As whole milk can be produced on the farm and delivered in the city at a lower figure than this, it will be seen that for supplying the city with milk the proposition is not to be considered. For the supply of localities where whole milk in its natural state cannot be obtained the manufacture might be undertaken, although even then the high prices it would be necessary to get in order to leave a reasonable profit, would militate against large sales.

To manufacture 10 gallons of cream testing 35 per cent. butter-fat and suitable for restaurant trade would take the following:—

	£	s.	d.
Fat—unsalted butter—41 lb. 10¾ oz., at 1s. 9d.	**3**	**13**	**1**
Skim milk powder, 6 lb. 2¾ oz., at 1s.	**0**	**2**	**9**
Water			
	£3	**15**	**10**

This is equal to 7s. 7d. per gallon for materials. To this must be added the cost of manufacture, *i.e.*, labour, fuel, wear and tear of plant, ice, &c., with a small machine to make 40 gallons per hour, which would be a size suitable for most retailers, these would amount to at least 6d. or 7d. per gallon, bringing the approximate total cost of manufacture to 8s. 2d. per gallon. As a set-off to this, the retail price of cream is at the rate of 30s. per gallon, a price which certainly permits of a large profit being made. The wholesale price of cream is about 16s. per gallon, which would allow a margin of 7s. to 8s. per gallon to the manufacturer if he disposed of the cream in that way. What profit the manufacturer of ice-cream would get if he manufactured cream at 8s. 2d. per gallon and sold it as ice-cream, I am not in a position to state, but it may be taken for granted that it is a considerable one. In special cases where the retailer has a considerable turnover it is presumed that he is able to buy cream at specially low rates. and therefore the margin between normal and reconstructed cream would be considerably lessened.

As a trading proposition it would appear that it would not pay to manufacture reconstructed milk unless it could be sold at a much higher price than that now fixed in Sydney for the normal whole milk of a cow, but for the manufacture of cream for sale either as fresh cream or ice-cream, there is a considerable profit awaiting those who have such a trade. If reconstructed cream is made in large quantities it must bring down the price now being got for fresh cream. This, however, will not so much affect the farmer as the big distributing companies who handle his milk.

The results obtained confirm the opinion formed that the heating of butter to 180 degrees Fah. and holding it at from 140 degrees to 180 degrees for about an hour, is conducive to the development of rancidity and butyric acid.

From a report submitted by the Chemist of this Department it is evident that in processes of drying the milk to make the skim milk powder, and in heating the butter for emulsification, chemical changes took place, and the reconstructed milk and cream gave analyses differing somewhat from those of the normal milk and cream.

In a report submitted by the Biologist of the Department, it is shown that the reconstructed article is very clean, judging by the very low bacterial count—in fact, the plate developed of the sample of milk taken in a sterilised bottle was practically sterile. Judged from this aspect, such milk or cream cannot be too highly commended.

SOME RECENT PUBLICATIONS.

THE following new or extensively revised Farmers' Bulletins have been added to the Department's list:—

No. 58, Hides, Skins, and Sundries (Second Edition).
No. 129, The Beginner in Bee Culture (Second Edition).
No. 140, The Pruning of the Vine.
No. 143, Producing Lucerne Hay under Irrigation.

Each of these publications is obtainable from the Government Printer, Phillip-street, Sydney. Price, 10d., post free.

FERTILISERS ON RIVER SOIL.

"I INTEND planting cauliflower and cabbage plants in February, on fairly stiff river ground, and would be glad if you would advise the best artificial manure to use."

The answer provided was as follows:—If the soil is rich alluvial, there is little necessity for heavy manuring. As the soil is described as river ground, artificial fertiliser only should be sufficient. The mixture recommended is equal quantities of dried blood and superphosphate. If only a small area is to be planted, one ounce of the fertiliser can be dropped at each spot along the drill where a plant is to be put in. This is quickly worked into the soil with a pronged hoe. If the area is large it will be necessary to broad-cast the manure (say at the rate of about 6 cwt. per acre), and to work in by harrowing.

A top-dressing of sulphate of ammonia or nitrate of soda, at the rate of 1 cwt. per acre, applied just before the plants commence to heart, is usually productive of an increased yield. This fertiliser should be dusted between the rows of plants, and lightly worked in either with the hoe or the cultivator. —A. J. PINN, Inspector of Agriculture.

Onion-growing in New South Wales.

W. D. KERLE, Inspector of Agriculture.

IN view of the large quantities of onions that are annually imported into New South Wales from other States (notably Victoria and Tasmania), and of the natural facilities for the production of the crop which portions of our own State possess, the development of onion-growing into a substantial local industry would seem to be long overdue. New South Wales has ample land of a suitable type, a climate that is particularly well adapted to the crop, and a season several weeks ahead of the southern states, which gives the New South Wales grower a great advantage in marketing. Our farmers are, unfortunately, loth to undertake onion culture, mainly because of the tedious work involved in keeping the crop free from weeds, though weeding is not arduous if care has been taken in the preparation of the land and a deep preliminary ploughing is followed by a succession of harrowings extending over some months. By this means the work after planting is reduced to a minimum. Successive sowings on the same land for a number of years still further reduce the weeds, and are recommended, for, unlike most other crops, onions may be grown for ten or twelve years without a rotation crop, provided no disease makes its appearance. The seed-bed must be fine and moist at sowing time, and must have a firm subsurface.

The ideal climatic requirements for onions are warmth, ample moisture, and absence of strong winds. Owing to a comparatively deep-rooting habit, however, the crop will withstand excessive heat, and will weather dry conditions longer than most others. The soil chosen should be well drained and of a loose, friable nature, and the best crops are obtained on black or red volcanic or dark sandy loams. The keeping quality and size of the bulbs is largely determined by the nature of the soil. Onions grown in sandy soil mature quickly and are of large size, but they are of poor keeping and carrying quality, while those grown on chocolate or black soils of a stiffer nature have thick skins, keep and handle well, and are of greater substance and solidity of flesh.

Onions may be sown between the end of February and the end of August, according to the variety used and the earliness of the district. To ensure the crop ripening before the heat of summer in short-seasoned districts, early sowing of early-maturing varieties is advisable. The seed may be sown direct (by hand or by machine) in drills 10 to 18 inches apart, at a depth of ½ to 1 inch, according to the looseness of the soil, or in nursery beds for transplanting. The latter method is to be preferred, as it ensures a more even stand, larger bulbs, and a considerably increased yield. Transplanting should be done when the plants are 3 or 4 inches high, and it is advisable to cut the tops of the young seedlings to within an inch of the crown, and to trim the roots in order to encourage deep rooting. About 4 lb. of seed per acre is required, if it is to be drilled in, and 1½ to 2 lb. if it is to be sown in the seed-bed. The after-cultivation of the crop consists of hoeing and hand weeding, and this should be commenced as soon as there is no danger of covering the plants with soil. It is essential that all weed growth be kept absolutely in check.

The onions are ready to harvest when the tops begin to change colour and die off, but they will keep better and can be handled better if they are harvested before they become too ripe and while the sap is still in the tops. The bulbs are pulled by hand and put into heaps in rows, in which they are allowed to remain until the tops can be easily detached from the crowns. The length of time they must be allowed to remain in the windrows depends upon the temperature prevailing, and if the weather is very hot care must be taken to prevent the scalding of the bulbs; in such weather it is often a good plan to spread the bulbs on the floor of the barn to dry.

Recent experiments carried out by the Department, in co-operation with Mr. Henry Short, "Warrawee," Dorrigo, have given evidence of the suitability of that part of the State for the cultivation of onions. The experiment was carried out on soil typical of the better-class land of the Dorrigo—a friable, loose, deep, naturally well-drained, light, chocolate-coloured loam of volcanic origin. The cultivation methods were those described above, and of the varieties tried Hunter River Early Brown Spanish gave a yield of 12 tons 17 cwt. per acre, Brown Spanish 11 tons 11 cwt., Extra Early Golden Globe 9 tons 1 cwt., Market Model, Brown Globe, and Extra Early Yellow Globe, all in the vicinity of 8 tons 15 cwt., Brown Spanish (Derwent strain) 7 tons 6 cwt., Mammoth Silver King 6 tons 4 cwt., and Ailsa Craig 4 tons 7 cwt.

Hunter River Early Brown Spanish is a very early variety, round-shaped, a medium keeper, of good flavour, and is particularly suitable for districts of short season for early sowing. Brown Spanish is an excellent main-crop variety, large (single ones going up to 1½ lb. in weight), firm fleshed, a good keeper, and of excellent flavour. Extra Early Golden Globe is large and of the shape indicated by its name, matures a week later than Hunter River Brown Spanish, has skin of a golden colour, fine flavour, a good appearance, and is a good keeper. Market Model (a main crop variety) is large, even, and brown-skinned, an early maturer, a good keeper, and of good eating quality. Brown Globe is very similar to Brown Spanish. Extra Early Yellow Globe is large, early, globular, with nice brown colour, mild flavour, and an excellent keeper. Brown Spanish (Derwent strain) is a thick brown-skinned strain, large, an excellent main crop variety, and an excellent keeper and eater. Mammoth Silver King is a fine white large onion, a medium keeper, with firm flesh, and a mild flavour. Ailsa Craig is of exceptionally large size, has light-brown skin, mild flavour, and keeps fairly well. Many onions of this variety scaled up to 2 lb. in the experiment mentioned.

With exhibits comprising onions from these experiment plots, Mr. Short obtained first prizes at all the agricultural shows at which he competed. The plateau is at present so isolated as to make the cost of carting a limiting factor in the development of a local onion industry, but with the completion of the railway now in course of construction the outlook will be full of possibilities.

SUDAN GRASS ON THE SOUTH COAST

As a drought-resistant fodder for the drier districts of the State, Sudan grass has established for itself a very definite reputation, but its utility on the coast is less marked, and the general experience of South Coast dairy farmers is that this grass is not of the same value as maize or sorghum for feeding to dairy stock, either as green fodder or ensilage, and that it is of no value for grazing purposes, as natural pasture is usually available at the time that the Sudan grass is fit to graze.

For several years Sudan grass has been under test on the South Coast to ascertain its value as green fodder for dairy cattle, experiments generally indicating that it is not to be compared with the other two crops mentioned so far as yield is concerned. Trials carried out last season on farmers' experiment plots were designed with a view to determining to what extent the yield might be increased by use of artificial fertilisers.

The fertiliser trial plots were sown at five centres, four different mixed fertilisers and superphosphate in two strengths being tried at each. A mixture of equal parts of superphosphate and bonedust at 2½ cwt. per acre gave the best results, yielding increases over the unmanured check plots varying from about 1 to 2½ tons per acre. At one centre (Wetherill Park), however, portion of the crop was cut for hay, which when cured proved of very fine quality, and indicated a local use for Sudan grass for this purpose, a larger yield being obtainable from it than from oats.—R. N. MAKIN, Inspector of Agriculture.

PAPER MULCH FOR PINEAPPLE GROWING.

ACCORDING to a paper read by Mr. A. T. Longley, at the annual meeting of the Hawaiian Pineapple Packers' Association, experiments have shown that the use of mulching paper materially increases pineapple production per acre. The idea of a paper mulch for sugar-cane was patented some years ago, but no experiments with pineapples were conducted until 1919. It is estimated that there are now 461 acres planted in paper, of which 68 acres will fruit in 1922.

The paper mulch appears to consist of a strip of paper in which are cut holes large enough for the pineapple plants to grow through. The first yields from the method were obtained last year, and according to Mr. Longley it was found that the plants in paper grew uniformly larger, greener, and more healthy, and the fruit larger (equal to a little over 3¼ tons per acre) and better conditioned. The paper mulch prevents the growth of weeds and the packing of the soil under heavy rains, thus greatly reducing the cost of intercultivation. In an experiment at the Hawaiian Pineapple Association's experiment station, the plant growth on paper mulch was three times greater in weight, and much healthier than on other plots.

Parasites of Olive Scale.

(*Lecanium oleae*)

W. W. FROGGATT, F.L.S., Government Entomologist.

In August last, Mr. E. W. Rust, of the State Board of Horticulture, of California, arrived in Sydney after two years in South Africa, where he had been studying the effective parasites of the brown bug or olive scale, one of the serious pests of the citrus orchards of the State of California. A good deal of assistance was given him by the Entomological Branch, and endeavours were made through the fruit inspectors of the Department to locate olive scale in their respective districts.

In company with Mr. Luke Gallard, Fruit Inspector in the Pennant Hills district, Mr. Rust took several trips in that locality, collecting specimens of the parasites. At one time olive scale was very plentiful about Pennant Hills, but native parasites, such as the scale-eating moth (*Thalpochares coccophaga*), whose larvæ destroy large quantities of the scale, and several ladybird beetles (*Rhizobius* sp.) keep it in check to a certain extent, and the introduced and indigenous hymenopterous parasites seem to have become so firmly established that the olive scale or brown bug has ceased to be a serious orchard pest in the county of Cumberland.

In a paper on the subject, Mr. Gallard writes :—" The only place I could find olive scale was on an occasional passion vine, and wherever I found any, I noticed it was fairly studded with pin holes, which revealed the fact that a number of parasitic wasps had emerged from it. Having heard similar reports from other coastal districts I decided to collect specimens, wherever available, and to breed out the parasites. I obtained specimens from five places. From four out of the five I bred the well-known humped-back introduced chalcid *Scutellista cyanea.* Among the others bred were *Coccophagus orientalis,* a small black species with clouded wings, and two other species, one, a little longer, which has a long, well-pronounced ovipositor, and another black species about twice the size of *C. orientalis,* which has a stouter body and wider space between the eyes.

" Of the genus *Aphycus,* I bred *Aphycus lounsburyi,* the golden chalcid, which has a fairly stout yellowish body, with stripes across the abdomen, another species of about the same size, darker yellow in colour, with a metallic greeny-blue sheen on the thorax, and the two anal segments of the abdomen, and another light black species with white legs. Also seven specimens of another genus with beautiful, delicate, fringed wings. These are very small, slender in body, fairly long in the legs, and appear to have a long double-elbowed antennæ, which they move about very briskly. The latter are probably undescribed species.

" I also collected a quantity of another allied scale (*Lecanium filicum*) from a birds-nest fern, and from it I bred three of the same species, with banded wings extending well over the abdomen."

The Energy Value of Some Dried Fruits.

A. A. RAMSAY, Principal Assistant Chemist.

WHAT is the "fuel" or "energy value" of, say, two shillings' worth of dried apricots compared with that of two shillings' worth of eggs? With a view to collecting information of this nature, a local co-operative society interested in the production of dried fruits recently forwarded to the Department samples for analytical comparison with some common foods.

The chemical analyses of the dried fruits submitted for examination resulted as follows :—

Variety of Dried Fruit.	Percentage Composition.						Fuel Value per pound.
	Water.	Protein.	Ether Extract.	Woody Fibre.	Ash.	Nitrogen-free Extract.	
Apricot	22·30	5·10	·10	2·44	4·62	65·44	1,316·26
Peach	21·75	3·78	·19	2·21	3·08	68·99	1,361·54
Nectarine	20·64	3·83	·12	1·81	3·36	70·24	1,382·77
Pear	22·26	2·58	·14	3·87	1·91	69·24	1,341·76
Prune	22·54	4·19	·08	1·44	2·08	69·67	1,377·17
Apricot (whole)	20·13	5·18	·10	2·68	2·19	69·72	1,396·36

It is a difficult matter to compare the values of various substances as foods and to express the value of one food in terms of another. Standard dietaries require the diets to contain a mixture of protein, carbohydrate and fat, all these being necessary constituents, and the difficulty of expressing the value as a food of a substance consisting largely or exclusively of fat or protein, with one consisting largely or entirely of carbohydrate, is apparent. We can, on the other hand, compare the fuel or energy value of foods, and this has been done in the appended table. It must, however, be clearly understood that the energy or fuel value must not be confounded with the "food value" or "value as a food" of the substance, and that it is not contended that the amount of a protein food yielding 1,000 fuel value units or calories is the equivalent for dietetic purposes of the amount of a carbohydrate food also yielding 1,000 calories.

In order to express the capacity of foods for yielding heat or energy to the body the term "fuel value" is commonly used. By the fuel value we mean the amount of heat expressed in calories equivalent to the energy which we assume the body could obtain from a given weight of food if all the nutrients were thoroughly digested. The calorie is, therefore, a standard which is used for estimating the energy value of foods as the foot-rule is used for measuring lengths.

In the following table is given (1) the fuel value or amount of energy yielded by one pound of the substance; (2) the fuel value or amount of energy yielded by that amount of the substance purchasable last July for 2s.; (3) the relative fuel values, taking the highest as one hundred, and (4) the cost of 1,000 fuel units in shillings and pence.

	Fuel Value, per pound.	Fuel value, per Two-shillings' worth.	Relative fuel values taking the highest as one hundred.	Cost of 1,000 calories.
				s. d.
Apricot	1,316·26	1,316·26	14·59	1 6·23
Peach	1,361·54	1,485·31	16·46	1 4·16
Nectarine	1,382·77	1,382·77	15·32	1 5·36
Pear	1,341·76	1,894·25	20·99	1 0·56
Prune	1,377·17	2,065·76	22·89	0 11·61
Apricot (whole) ...	1,397·36	1,397·36	15·48	1 5·18
Oatmeal	1,504·06	9,024·36	100·00	0 2·65
Bread	1,132·87	8,365·79	92·70	0 2·87
Milk	316·17	1,223·58	13·56	1 7·61
Butter	3,532·84	3,532·84	39·15	0 6·79
Eggs	761·8	514·22	5·69	3 10·67
Jam	1,014·63	2,116·52	23·45	0 11·34
Beef, Rump	1,390·44	1,853·46	20·53	1 0·95
„ Rib	1,070·98	2,336·58	25·89	0 10·27
Canned Peaches ...	291·83	1,000·54	11·09	1 11·98

THE FODDER VALUE OF MAIZE STOVER.

Two samples of maize stover, which were forwarded by the Manager of Glen Innes Experiment Farm, were subjected to analysis with the following results:—

	Sample No. 1.	Sample No. 2.
Moisture	9·09	9·23
Albumenoids	4·37	6·62
Ether extract	0·39	0·33
Ash	8·52	5·65
Fibre...	22·27	32·39
Carbohydrates	55·36	45·78
	100·00	100·00
Albumenoid ratio	1 to 12·8	1 to 7
Nutritive value	60·6	53·14

Sample No. 1 consisted of maize stover for shredding, cut with maize binder on 17th March, 1921, and shocked in the field. Specimen taken about 20th May from shocks ready for shredding.

Sample No. 2 consisted of maize stover after the cobs had been pulled off in the ordinary way, and cut off about 20th May.

Both samples afforded a very dry feed compared with American analyses of maize stover, which (according to Henry's "Feed and Feeding") gives a moisture content of 40 per cent.—F. B. GUTHRIE.

To Improve the Market for Honey.

W. A. GOODACRE, Senior Apiary Inspector.

WHILE it is very important that the apiarist should be so competent in the management of his farm that he may obtain good crops of honey, it is also of great importance that he should employ the best methods in the marketing of the produce so that his money, time and labour may be used to the greatest profit. Concerning the distributive aspect of marketing, there is a tendency on the part of too many apiarists to place all their surplus honey on the city market, and to leave the demands of local and country trade more or less neglected. In the good season which now seems to promise it should be the apiarist's business to make an effort to improve local and country sales, and thus to prevent, as far as possible, the city market becomnig over-stocked. If every bee-farmer would be more of his own agent, and remember that every pound of honey sold in country districts is a pound less for a probably over-supplied city market, the honey market as a whole could not but be bettered.

Another tendency which might be modified with advantage is that of putting up practically all honey in 60 lb. containers. More use should be made of smaller containers, more especially for the country trade, so as to cater for all requirements. Even with good seasonal conditions obtaining over the State generally, there is little doubt that if the resulting supplies were better distributed and the demand for the product stimulated, all the honey produced for the next season or two could be disposed of within the State. Can apiarists design a better scheme of distribution ? Certainly it is worth their while to try, for the well-being and progress of the industry depends to a large extent upon the decentralisation of supplies and the improvement of marketing conditions and methods generally.

As to stimulating the demand for honey, many simple means and apparently trivial precautions may be employed with excellent effect. For instance, an attractive display of apiary products at local shows brings the product before public notice and improves sales—bee-keepers who stage such exhibits are usually well repaid, and the industry generally also benefits. The advertising of honey, and the issue of small sample bottles to likely purchasers is also often productive of good results, while the utmost care in the treatment of the product, absolute accuracy as to weight, and the use of attractive containers and bright, tasteful labels all contribute to the desired end, enabling the product to speak for itself, so to speak. The American method of placing a sign "Honey for Sale" at the home apiary when it is situated near a main road is worthy of attention by local bee-farmers, too.

A number of New South Wales bee-keepers are nowadays directing their attention toward co-operative marketing, and such a movement deserves the utmost possible commendation and support. As to other primary producers, co-operation offers to the apiarist a solution of many of the difficulties with which he is beset, and with its aid it should be possible for him not only to obtain a better regulated local market, but to establish reliable export markets for use when the supply exceeds the local demand. With a co-operative marketing scheme properly established, some of the measures to popularise the consumption of honey now recommended to the individual apiarist would automatically become the business of the body representing the combined apiarists, which body (such is the virtue of co-operation) could carry out the work more efficiently and economically. One of the tasks of such a body might well be the pursuance of a propagandist advertising campaign in favour of honey as an article of food.

The possibilities of co-operation for the bee-keeper are indeed almost illimitable, but although there is evident among more progressive apiarists a movement in the right direction, the familiar obstacle of shortage of capital hinders progress. The supply of capital is itself dependent upon active co-operation, however, and my own immediate advice to apiarists is this :—"Get together, vote the modest levy necessary for the financing of your small local co-operative movement, and everything else will follow."

THE VALUE OF COWPEAS.

"COULD you give me any details of the cowpea as fodder for dairy cows; also, is it of any commercial value?"

A reply was sent to the following affect :—Although they can be used as such, cowpeas have not their best value as green fodder for dairy cows. Further, there is the objection that cattle do not take to them too readily, some cows probably not at all. However, it is possible to get cows accustomed to them. Cows should be turned on to them, or the crop should be soiled when the first pods are ripe. Pigs utilise cowpeas better for grazing than do dairy cows, particularly when most of the seed is ripe.

For hay, cowpeas are largely used for all kinds of stock in America, though the practice is hardly known here. They should be cut for hay when many of the pods are ripe. The hay is difficult to cure, but its feeding value, if well made, is about equal to lucerne hay. Cowpea hay is not known on the market, and is, therefore, of no commercial value outside the farm where it is raised. Here, however, recognition of its value as a source of protein for dairy cows, in the absence of lucerne, can be made to effect much saving in the purchase of high-priced concentrated feeds, such as bran, oilcake, or linseed meal.—H. WENHOLZ, Inspector of Agriculture.

Cottage Landscape Gardening.

[Continued from Vol. xxxii, page 900]

E. N. WARD, Superintendent, Botanic Gardens, Sydney.

THE piece of ground treated in this article measures approximately 146 x 76 feet; it is irregular in shape, and slopes from back to front and from the points A to B. There is not the same scope for graceful treatment of such awkward areas as of those with level ground and equal boundaries. The laying out of such sloping areas calls for more than the exercise of good taste—there are certain fixed rules to be observed. In this case the architect has designed the cottage in proper proportions, but these proportions can easily be spoiled by faulty planting and lay-out. Where the ground falls from the road to the building, care must be taken that the cottage does not give an impression of being low and damp (however dry it may actually be), for such an impression would sooner or later produce a feeling of depression.

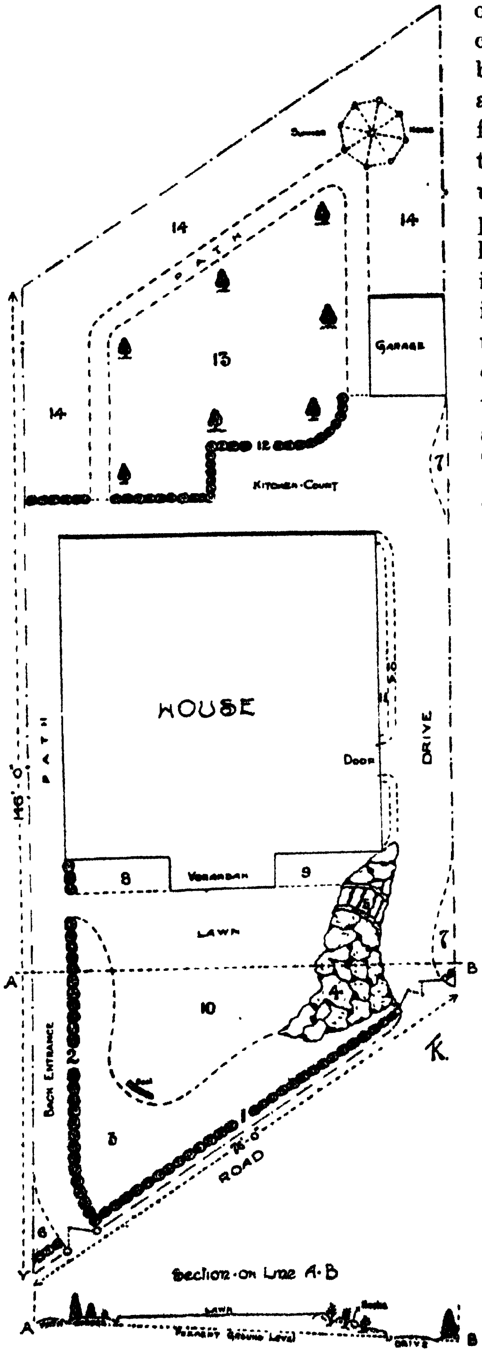
In the case of the area under discussion, the ground falls sharply from the house to the road, and the architect's proportions must be so preserved as not to give one corner a cocked-up appearance and the other a low one.

For some distance from the verandah the ground must be made level (see section line A to B). The ground falls nearly 5 feet. The filling necessary to accomplish the effect shown in the section should have come from excavations on the site of the house and on the drive to the garage, and should be retained in the manner shown on the plan as 4. The rockery will gradually disappear as the back entrance is approached, when the slope may be continued by a grass bank dying out just behind the seat on the lawn numbered 10.

To give privacy at both entrances, specimen evergreen shrubs are planted at 6 and 7. The drive will permit a car to go direct to the front door, proceeding and turning its nose into the back or kitchen forecourt, then backing into the garage ready for driving out again. This forecourt is also designed for the laundry drying ground.

Drives and Paths.

The drive, paths, and forecourt should be made with a gravelly-clay sanded surface. Asphalt should never be used if gravel of any kind can be secured. Asphalt is bad enough in the street as a public utility, but round a dwelling it only attracts heat, while on garden paths it breeds insects that attack vegetation growing alongside, as, for instance, red spider, which affects the plants to such an extent that they become a prey to every other pest that comes along. Asphalt is popular because it is easily procurable, can be laid by any handy man on an even surface of almost any kind, and requires no sub-drainage, for its hard surface acts as a surface drain. No wonder that with such factors to recommend it we see so much of it. Cement paths with concrete edgings are also used, but these (although not so hot and depressing as tar) are too formal for garden paths round the home, though one can understand their use round public buildings such as hospitals, where cleanliness is so essential. Bricks laid in crazy patterns are being used wherever bricks are cheap, and are to be preferred to tar or cement, but these again are hard and formal. The ideal is a properly made gravel path, formed so that water runs from it as from a duck's back. Such a path must be subdrained and trenched, for it is still part of the garden. A strip of untrenched ground running through the garden in the form of a path acts as a buffer against a free sub-watertable, whereas a strip of made garden that has been given a crust of suitable material for a path interferes with neither drainage nor root action. The roots of plants should feel as happy underneath paths and lawns as they are in the cultivated borders.



Included in good gravel paths are those made like chip tennis courts; that is, sanded on the surface. These are pleasing, and will stand a good deal of wear and tear if the necessary attention is given at the right time. In prolonged dry weather they are apt to crack and break up, but a watering will close up the cracks and the surface can be made even and smooth again by a light sanding if it is run over it before it becomes dry again.

How to Make a Path.

Having pegged out the outline and fixed the levels or the grade, the first consideration should be the method of taking off the surface water. To carry water a long distance on garden paths with surface gutters is ugly, for these gutters are not efficient unless made large enough to carry off the biggest storm load that may fall on its surface without scouring and consequent loss of the path material. Garden paths should be 4 feet 6 inches wide—just wide enough to allow two persons to walk abreast comfortably. When water has to be taken off by surface gutters they take up a third of the path's width, so that when two persons are walking abreast they are compelled to walk partly in the gutters.

Draining.

The most effectual method of draining a path is to drop the surface water into neat gully shafts at equal distances on both sides, grated the shape of the path's surface. These gullies should be 8 or 9 inches square at the top and about 15 inches deep. The outlets should be 4 inches from the top through a 4-inch drain pipe, running into a row of 6-inch pipes laid a foot below the surface in the centre of the path, the outlet of which pipes should be the main drain of the garden or the lowest point. The gullies are best made of brick, the bottom laid without mortar, so that water below the outlet may gradually drain away, leaving the accumulated silt to be replaced on the path surface from where it was washed.

Ballast.

Having completed the drainage, the sides of the paths should be defined. Next dig out the soil to a depth of 4 inches at the sides and 3 inches in the middle, tread, ram, or roll as firm as possible, and build up with 4 inches of ballast composed of brickbats or stones, varying in size from 2 to 4 inches. Lay this right up to the path surface, and roll the surface and make it as even as possible, taking care that the centre is kept 1 inch higher than the sides or the top of the gullies. Then, and not till then, lightly sprinkle the surface with a blinding composed of gravel and clay (at least two-thirds clay.) Roll this until sharp pieces of ballast project, the blinding being necessary to hold the ballast. A further thin blinding of the same material with any coarse pieces sifted out should now be spread and again rolled.

This second blinding is to hold the gravel which the path is then ready to receive. Spread this thinly, using no more than the blinding can take and hold, for when the path is finished there should be no loose gravel on the surface. Loose gravel is only permissible on carriage drives for horses and motor cars to crunch down, to be raked up again for appearance sake, but garden paths should have a smooth and firm surface that will stand a bass broom being lightly drawn over it for the filling up of any slight irregularities.

The chief aim when dealing with the ballast should be to bring it right to the surface. It is unnecessary to trouble about leaving room for blinding or gravel; let them take care of themselves—they are quickly lost in the ballast surface. The most common fault is to use too much blinding. This takes up too much gravel and makes a surface that in wet weather becomes soft and "picks up," while a thin, well-rolled, well-held sprinkling of blinding and gravel allows the surface to drain quickly and makes a face that wears well, being right on the ballast, and consequently leaving little risk of scour. When a path like this has been brought to such a stage that a broom can be drawn over it as described, one has the ideal garden path. Such a path will have no surface gutters; it will have a fall of 1 inch to each side, and it will be immaterial how much fall it has lengthways, providing the water drops into a gully shaft every 15 feet or so.

Planting.

At the point numbered 1 in the plan plant a dust-proof hedge for privacy, In colder districts *Cupressus Lambertiana* may be used, and in warmer coastal places *Cupressus sempervirens*, while in the hot inland districts *Duranta, Ligustrum* and *Tecoma* should be used.

No. 2 is a tall hedge of roses (Tausendschon, climbing Maman Cochet, Ards Rover, and Souvenir de Leone Viennot) on a trellis.

No. 3 is a plantation of roses, pillar varieties, like Zepherine Dronhin, George Arends, Frau Karl Druschki, Paul's Scarlet Climber, Gwen Nash, strong-growing kinds like Madame Abel Chatenay, Gruss an Teplitz, Gustav Grunerwald, La Tosca, Irish Elegance, and Warrior being planted in the corner. In front of the rose hedge towards the house plant more compact growing kinds, such as Radiance, General Macarthur, Lady Hillingdon, Mrs. Herbert Stevens, and Hadley.

No. 4 is the rockery, and into the pockets of this rockery rose species like Altaica and Hugonis and a few polypoms, like Orleans, should be planted. In the top pockets one of the bush callistemons or Arundo donax and Strelitzia reginæ should be planted, and a little lower Mandina domestica, the variegated hydrangea, crinums, alæs, but not the spring and sharp-pointed yuccas and agaves, as these are not suited for the home garden, and there are a wealth of plants suitable for a rockery without them. Aspidistras, cordyline, Miscanthius sinensis and zebrina, and acanthus, with the smaller growing gazania, "pig-face," and ivy-leaved geraniums will give a well balanced rockery.

The stone steps marked 5 should be made of either rustic logs or with stone flags with variegated ivy as an edging. Nos. 6 and 7 should have some evergreen, upright-growing shrubs that can be kept furnished at the bottom, such as Eugenia Luchmanni, Ligustrum lucidum variegatum, Pittosporum erioloma or some tall-growing cypress suitable for the particular district. Reserve 8 and 9 for any perennial especially fancied. If the aspect is right, Gerbera, the Barberton or Cape daisy, carnations, bouvardias or ericas may be used. If the aspect is towards the south a collection of tree begonias would give as much pleasure as anything, such kinds as Corallina, Carnea, Lucerna, Smithi, Taliana, Silver Spots, Indian Princess and Mabel Roseby, with an edging of the everflowering dwarf Begonia semperflorens, the best variety of which is Prima Donna.

The lawn (10) should be laid with buffalo (couch grass would run into the rockery), and at 10A and the edges of 7 rosemary or lavender would be appropriate. The border at 11 is not very wide, but is sufficiently so to grow ivy-leaved geraniums, trained about 5 feet up the wall. This would brighten the drive as nothing else could, and is very hardy. No. 12 could be a hedge of hibiscus (George Harwood), psidium or guava, or a 6-foot fence with loganberry or passion fruit. No. 13 was designed for a vegetable garden with a few choice fruit trees, such as lemon, fig, loquat, persimmon, pomegranate, a Wickson plum, and a mulberry. This plot would also suit the dahlia, sweet pea, chrysanthemum or carnation fancier, with or without the fruit trees.

No. 14 could also be used for vegetables, salads, herbs, strawberries, and rhubarb, but if privacy is desired, then from the hedge right round the summerhouse to the back of the garage plant wattles, flowering gums, and Christmas bush, with here and there a bottle brush.

Plant behind the garage a Bougainvillaea magnifica, to cover the roof to keep it cool, or some fragrant and strong-growing rose, like climbing Devoniensis.

(*To be continued.*)

COCKEREL OR PULLET?

NOT until chickens attain the age of from four to six weeks is it possible to determine their sex with any accuracy. At this age the cockerels can generally be recognised with more or less certainty by the character of the head, tail, and saddle hackle. At this age the pullets will generally have the larger and more compact tails, while the tails of the cockerels will incline to be stumpy. Again, the saddle hackle in the cockerel will be different in that it will have long, narrow feathers on the saddle, while the pullet's feathering on the same portion of the body will be practically the same as on the breast and sides. The last-mentioned point applies to shape of feather, not to colour. These and the general masculine appearance of the cockerels are a guide in distinguishing between cockerels and pullets, but some experience is naturally necessary before one becomes proficient in culling out.—JAMES HADLINGTON, Poultry Expert.

Pure Seed.

GROWERS RECOMMENDED BY THE DEPARTMENT.

THE Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Wheat :—

Bomen	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Temora.
Canberra	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Temora.
Clarendon	Manager, Experiment Farm, Glen Innes.
Cleveland	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Glen Innes.
College Purple	Manager, Experiment Farm, Temora.
Comeback	Manager, Experiment Farm, Temora.
Currawa	Manager, Experiment Farm, Temora.
Federation	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Trangie.
	Manager, Experiment Farm, Temora.
Firbank	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Trangie.
	Manager, Experiment Farm, Cowra.
Florence	Manager, Experiment Farm, Trangie.
	Manager, Experiment Farm, Coonamble.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Glen Innes.
Genoa	Manager, Experiment Farm, Glen Innes.
Gresley	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
Hard Federation	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
Improved Steinwedel	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Trangie.
	Manager, Experiment Farm, Temora.
King's Early	Manager, Experiment Farm, Temora.
Major	Manager, Experiment Farm, Temora.
	Manager, Wagga Experiment Farm, Bomen.
Marquis	Manager, Experiment Farm, Glen Innes.
Marshall's No. 3	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
Penny	Manager, Experiment Farm, Temora.
Sunset	Manager, Experiment Farm, Coonamble.
Waratah	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
Warden	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
Warren	Manager, Experiment Farm, Trangie.

PURE SEED—*continued.*

Wheat—continued.	
Yandilla King	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
Zealand	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Temora.
Oats:—	
Algerian	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Glen Innes.
Guyra	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Glen Innes.
Lachlan	Manager, Experiment Farm, Cowra.
Ruakura	Manager, Experiment Farm, Temora.
Sunrise	Manager, Experiment Farm, Trangie.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Coonamble.
	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Glen Innes.
Sudan Grass:—	J. Cavanagh, Curlewis.
	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Bathurst.
Clovers:—	
Shearman's Clover (roots)	J. H. Shearman, Fullerton Cove, Stockton.
Kikuyu Grass:—	Principal, H. A. College, Richmond.
	Manager, Wollongbar Experiment Farm, Lismore.
	Manager, Experiment Farm, Grafton.
Elephant Grass:—	Principal, H. A. College, Richmond.
	Manager, Wollongbar Experiment Farm, Lismore.
	Manager, Experiment Farm, Grafton.

In addition to those tabulated a number of crops were inspected and passed, but as the growers failed to forward samples their seed has not been listed.

LACHLAN OATS.

AMONG the varieties developed in Australia, I would mention first the Lachlan oats, bred by J. T. Pridham, and now firmly established in New South Wales and Western Australia. It is one of several selected from a cross between Vilmorin's White Ligowo, a white-grained French variety, and Algerian. It ranks with Cape oats in rate of growth, but is taller and stronger in the straw. The foliage is dark-green, and the crop is hardier and stands up better than Algerian oats. The grain is like a well-grown sample of Algerian, but is lighter in colour, and a little stouter. It holds its grain well, and yields quite as heavily as Algerian oats in dry districts. It is probably the most promising of the varieties evolved in Australia.—W. J. COLEBATCH, Principal of Roseworthy Agricultural College, South Australia.

Poultry Notes.

JANUARY.

JAMES HADLINGTON, Poultry Expert.

PERHAPS never since poultry farming has reached the importance of an industry, should the poultry farmer have been able to look forward with more confidence than to the year now commencing. Poultry food has become much cheaper, while eggs and poultry products generally are keeping up in price, and according to reports from London, our eggs have made a name in that market that would appear to ensure us a share of the big business to be done in eggs there, and in America too.

The prospects for the poultry farmer are thus most encouraging, and it will be surprising if a big move forward is not made by the industry during the next two or three years. During the years preceding 1921, war time and drought conditions left the poultry farmer struggling to hold on, but during those times of stress it was confidently asserted in these notes that to those who could manage to pull through the adverse conditions then prevailing there was a good time ahead. This optimistic outlook is now being amply justified, and the outlook for 1922, on the commercial side, is certainly most promising.

Other Conditions.

The view expressed above will be generally admitted. But there are other things in the poultry industry that are not quite so satisfactory. The lack of success of many engaged in the industry is a matter for regret. Some of this is due to causes which are not altogether within the control of the farmer. On the other hand, very much of the non-success seen is due to want of method and lack of aptitude, accentuated by a multiplicity of impracticable and sometimes foolish ideas, promulgated ostensibly from far and near for the benefit of the farmer, but more often than not leading to his undoing. If poultry farmers, as a whole, would seek to systematise their work, and writers of poultry matter would adhere to what is known to be sound and practical, and would drop the over speculative and questionable ways that lead to nowhere, we would soon have a healthy, prosperous industry, with the cost of production reduced by 25 per cent., and the failures at a minimum.

It is desired to emphasise the fact that, with the exception of experiment work, both on the Hawkesbury Agricultural College Demonstration Poultry Section and Egg-laying Competition, and at Grantham Stud Farm, the whole of the work of rearing, feeding, and general management is systematised, so that, year in and year out, the same uniform results are obtained. There are also many privately-owned farms where the same practices are successfully followed. On the other hand, there are many poultry farmers, with equal opportunity, that are carried away with every supposedly new idea, the results being unsatisfactory and chaotic, as would be the case in any industry following similar unscientific methods.

Let us get down to bedrock, and make a new start in 1922.

Seasonal Diseases of the next Four Months.

The disease known among poultry farmers as warts (chicken-pox) is a seasonal expectation over the next four months. The malady is in reality an eruptive fever affecting young poultry, the eruptions being almost confined to the comb, face and wattles, but sometimes it appears also on the legs. The first sign of the trouble is generally that the birds become less keen for their food, though this may not be very noticeable until the eruptions appear on the face, comb, and wattles in the form of small sores. In a very severe outbreak, small yellow blebs appear all over the fleshy parts mentioned above, and gradually burst, discharging their watery fluid and then forming into scabs, which appear to itch, so that the birds often scratch them, causing the eruptions to extend and form a mass of scabs all over the exposed surfaces, often getting into the corner of the eye. These constitute the .worst cases, because many of the affected birds become blinded for the time being, and are unable to see to eat their food.

When chicken-pox has once broken out it will run its course through all the unprotected young stock on the farm. Mosquitoes, while not the cause of the trouble, will of course aggravate it, because every puncture, no matter whether caused by an insect or a scratch, is liable to infection. Birds over a year old very rarely take this disease, though I have seen cases where even old birds have become infected through abrasions on the comb and wattles.

The malady often breaks out with such virulence that all young birds on the farm show signs of the disease within a week from the first case noticed. When this occurs it is too late either to prevent or check its course, and all that can be done is to apply some agent for drying up the sores and allaying the itching that is such a feature in the aggravation of the trouble. For this purpose there is perhaps nothing better than to paint the sores with tincture of iodine daily. Another simple and always handy emollient is common laundry blue, which can be applied in the same way.

Preventive Measures.

It is in accordance with modern scientific thought and practice that the question of prevention by means of a serum or lymph should be advocated, and it is understood that some attempts have been made in this direction, but with little or no success along practical lines. To be of use in ordinary farm work such a method of prevention would, of course, have to be both inexpensive and simple of application.

However, in the absence of any more scientific method of protecting young stock from this disease, we have a protective agent at hand in flowers of sulphur, the use of which has been advocated in these notes each year since their inception. Hundreds of poultry farmers can testify to its effectiveness, but there are others who will aver that it has been used without effect. To the latter I can only reply that the sulphur has not been used in the exact manner, or perhaps the quantity prescribed, in which case it will not have been thoroughly effective.

Again, even where it has not been properly used, if used at all there has probably been a modification of the severity of the disease that has not been full appreciated, because the farmer may not have had experience of the full effects of the disease upon a totally unprotected flock.

A few blebs on the comb and wattles, for instance, show the disease only in a mild form, while in the case of a severe attack the whole of the fleshy parts of the head become covered with a festering mass of sores, and many birds are rendered temporarily unable to see owing to the scabbing over of the eyes It is in an epidemic of such severity that the farmer realises how seriously the disease can affect his flock when it is wholly unprotected.

The Protective Qualities of Flowers of Sulphur.

I have generally recommended that a tablespoonful of sulphur for the equivalent of every fifty adult birds be given in the morning mash for a period of three weeks, and that for the next three weeks Epsom salts should be added every third day to the drinking water at the rate of one ounce to the gallon. This alternation of treatments should be continued till the period over which chicken-pox is seasonable has passed. It has been found that even this very simple direction has been misunderstood, and it is somewhat surprising in how many ways and periods and quantities the sulphur has been given—sometimes it has been altogether omitted in favour of Epsom salts only.

Let it be emphasised that the full protective benefit of this agent will not be obtained unless the advice given is carried out in its entirety and to the letter, but in order that no misunderstanding may arise it may be stated in terms of weight for weight. To every 7 or 8 lb. of the mash, whether wet or dry, one ounce of sulphur should be mixed, commencing well ahead of the time when the disease is liable to appear, and continuing till the season is over, which means that it is advisable to commence the sulphur treatment in this State in the first week in January and to continue it through the summer to about April.

How to Encourage Roup.

The months in which roup among young stock becomes a factor to reckon with are now approaching. It has been told in these notes how to guard against roup, but the practices that encourage it are still much in evidence. Perhaps it will be a change to advise how to encourage an epidemic of this disease.

First, it is quite unnecessary to bring an infected bird into the yard, because the micro-organisms responsible for the disease are ever present on the poultry farm, and the poultry farmer who prides himself on not having had it, and who thinks he can keep clear of it by not introducing it, is living in a fool's paradise.

All that is necessary to start a real epidemic of this disease is to pack a large aggregation of young stock together in ill ventilated houses and keep the roosts close together.

Many poultry men are afraid of draughts in their poultry-houses, and think that they are the cause of roup. The fact is that the want of fresh air is the greatest single factor in the starting of an epidemic.

Too much scrub and undergrowth generally on or about the yards is also bad, from the fact that it prevents a free circulation of air through the farm. A little shade is good, but in this case there can be too much of a good thing.

A free leaflet on this disease is in course of preparation.

THE GREY VINE CURCULIO (*Leptops tetraphysodes*).

THIS weevil has been collected in the scrub of the northern districts of New South Wales and probably has a wide range, but the following notes constitute the first record of it as a serious pest. Particular inquiry as to its character and habits was prompted by a report by Mr. J. R. G. England, of Valla, *via* Macksville, that it was attacking his vines.

All the vines attacked were very old, but had been heavily pruned; an adjoining block of young vines of the same variety were undamaged and free from weevil infestation. The weevils attacked the buds before bursting, and continued to feed on them (mainly at night) until the buds and young bunches were destroyed. The life history of the weevil is unknown, and the source of infection therefore doubtful. Examination of the roots of many native plants in the neighbourhood of the vineyard revealed no trace of the larval stages of the insect. The native plants were separated from the vines by open paddocks, moreover, and as the weevil cannot fly it is not likely that the infestation came from the native scrub. Careful observations of the conditions of the infestation suggested that the infestation originated in the vineyard, and that the larval stages were passed on the roots of the vines. The weevil is being made the subject of further investigation.

Tapping the vines with a stick, so as to cause the insects to fall to the ground, where they may be collected and destroyed, has proved very useful in mitigating the damage caused by this weevil, but as the area treated should be covered every two or three days the practice is a laborious one, and better methods suggest themselves. The beetle is wingless and consequently can only gain access to the tree by crawling up the stem from the ground, and if a band of tanglefoot mixture, about 2 inches wide, is applied round the stem about 4 inches from the ground, the buds cannot suffer. If a suitable material is used, such bands should remain effective for many months. Their efficacy is, in any case, easily renewed.—T. MCCARTHY, Assistant to the Entomologist.

Orchard Notes.

JANUARY.

W. J. ALLEN and W. le GAY BRERETON.

DURING the busy part of the fruit season one is compelled to some extent to neglect the cultivation. Indeed, some consider that after the crop is picked the trees require no further attention in this direction for the remainder of the growing season, but it should be remembered that in the case of early and midseason varieties the trees have to go through quite a long growing season after they are cleared of fruit, and if they are starved during that time they will fail to develop an ample supply of good sound fruit eyes for the following fruiting season. It can be seen, therefore, that last month's notes on cultivation still apply.

The Control of the Codlin Moth.

In the tableland apple and pear districts it is generally towards the end of December or early in January that the extent of the codlin moth attack becomes apparent. In addition to spraying with lead arsenate for this pest, it is wise where practicable when the entries of the grubs of the early brood become visible to make a thorough search of bearing apple and pear trees, and to pull off and destroy by burning or boiling the infected fruit. To be effective, this inspection and destruction must be carried out before the grubs have left the fruit. The searchers should be provided with small bags, such as sugar bags, suspended from their shoulders in a convenient position to carry the fruit they have picked off; larger bags can be left at convenient spots for the sugar bags to be emptied into.

Great care should be taken that the bags are sound, and that the work is not undone by small infected apples being lost through holes. It is imperative that the infected fruit that is collected shall be regularly destroyed by boiling or burning every day.

The prevention of the increase of the early brood by thorough work in this manner will give very gratifying results, provided there be no fresh infection from outside sources. In cleaning up an orchard that is badly infected as a result of previous neglect, it becomes one of the necessary operations if quick results are desired. In the latter case, or in districts where the moth is particularly bad, bandaging, together with regular destruction of harbouring grubs, should also be resorted to. This is as a trap for the grubs that have been missed in the inspection and that have left the fruit, and that, if not killed, will emerge as moths again and lay countless eggs to infect the later fruit.

The collecting of fallen fruit should be regularly attended to and any that is infected with moth or other grubs should be destroyed by boiling or burning. Many growers who are most careful in carrying out control measures against codlin moth and similar pests, do not take sufficient precautions against fresh infection from outside sources. One of the most serious sources of outside infection is the returned case; such cases should go through a boiling water dip before being taken to the orchard. This is a matter which could be handled by growers clubbing together, and having a dip operated between them at the railway yards.

The successful control of many insect pests calls for concerted action. It should be quite possible for growers to combine and form vigilance committees to see that thorough work in this direction is done throughout the district.

Scale Insects.

Citrus growers during the latter part of this month should keep a close watch on the trees for the various scale insects.

The young white wax first makes its appearance on the leaves, and later takes up its permanent location on the young shoots.

For a spray to be effective it must be applied before the earliest of the white wax to be hatched out has grown much larger than a pin's head. This often occurs before the young red scale has hatched to any great extent, hence it is often impossible to deal with both wax and red scale with one application of spray. If both be present, the young white wax can be dealt with by using the soda spray (1½ lb. washing soda to 4 gallons of water) as soon as it shows thick on the foliage and is starting back to take up its permanent position on the young shoots. Later the resin soda wash (a leaflet regarding which may be obtained, free of charge, from the Under Secretary and Director, Department of Agriculture, Sydney), can be applied when the red scale has finished hatching out.

Where fumigation is to be employed, the operation should be timed to suit the red scale when it has completed hatching, as even if the white wax is well grown by that time it will be killed by the fumigation. One of the great advantages of fumigation is that it can be delayed till the autumn; it is more certain then of all eggs being hatched out and a clean sweep being made.

Summer Training of Fruit Trees.

For the past two months mention has been made of the summer thinning and training of young deciduous fruit trees, but the shortening of laterals during the latter part of the growing season to accelerate spur development has not been touched upon. With varieties of apples and pears that will develop spurs satisfactorily along their laterals if the yearling laterals are given sufficient length at the previous winter pruning, such a summer treatment would be superfluous and a waste of time, but under some conditions certain varieties of these fruits will show very little tendency towards fruit spur development, even after the tree has reached a stage of sufficient development to carry a crop, and in such cases it is advantageous to accelerate fruit spur development by a summer treatment.

The most satisfactory summer treatment when this is necessary, is the shortening of the current year's laterals back to the last two or three buds that cluster more or less near its base, except in varieties where the buds are completely blind, when a longer cut must be given or dead stubs only will result.

This operation should be carried out towards the latter part of the growing season, say from the end of January to the middle of February, so that a long second extension of the lateral will not take place, but while there is still sufficient sap movement to develop short fruiting shoots or spurs, or merely to swell the buds so that they will form spurs or short fruiting shoots the following season.

Drying.

Elberta peaches will be ready for drying towards the end of this month. It is, therefore, an opportune time to draw attention to a method employed by the orchardist at Yanco Experiment Farm when dealing with this and other varieties of peaches suitable for drying.

After putting them through the ordinary operation of pitting and sulphuring, the trays are placed in the raisin drying racks, instead of being exposed direct to the sun on the drying green in the usual manner. By this method he obtains not only an extra fine quality of dried product, both in texture and colour, but the fruit also dries out rather heavier. Of course it is not suggested that it would pay to build racks specially for the purpose, but in cases where racks have been erected for raisins, and where only a small quantity of peaches has to be handled, the racks can be employed in this way, as, except for the late varieties, the time of drying peaches does not clash with that for drying sultanas or lexias.

An extra advantage is that during dust storms the hessian screens of the racks can be employed, and the fruit kept under the protection of the roof of the rack, thus saving the stacking, which is a considerable item during threatening or wet weather. It is a drawback that the fruit takes longer to dry in this way, and the trays are not liberated so soon, which means more trays for a given quantity of peaches, and precludes the method being employed for large areas of this fruit.

Full instructions for drying peaches and other fruits are given in Farmers' Bulletin, entitled "Fruit Drying." Price, 10d., post free.

WHERE THE ERADICATION OF TUBERCULOSIS IS APPRECIATED.

LATEST reports of the tuberculosis eradication work by the United States Department of Agriculture show that a total of 204,892 head of cattle in 8,839 herds have been accredited by the Government as free of tuberculosis infection, while 702,590 additional cattle in 56,113 herds have already been once tested and found free of the disease. On 1st August, 1921, a total of 1,159,294 cattle in 79,341 herds were under supervision in the tuberculosis eradication campaign. Furthermore, there were 218,531 cattle in 14,494 herds on the waiting list for testing. There is a constant increase in the number of animals and herds tested and accredited, and in the demands on the part of herd owners who desire to place their cattle under Government supervision.—*Weekly News Letter* of the Department of Agriculture, U.S.A.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1922.

Society.	Secretary.	Date.
St. Ives A. and H. Association	A. K. Bowden	Jan. 13, 14
Albion Park A. and H. Association	H. R. Hobart	,, 20, 21
Kiama A. Society	G. A. Somerville	,, 25, 26
Coff's Harbour A. Society	C. Vost	,, 25, 26
West Bargo A. H. and I. Society	L. J. C. Hicks	,, 26
Toronto Branch Agricultural Bureau	J. Froome	,, 28
Wollongong A. H. and I. Association	W. J. Cochrane	Feb. 2, 3, 4
Inverell P. and A. Association	A. L. Varley	,, 7, 8, 9
Shoalhaven A. and H. Association	H. Rauch	,, 8, 9
Fairfield West Progress Association	H. P. Godfrey	,, 9, 10, 11
Central Cumberland A. and H. Assoc. (Castle Hill)	H. A. Best	,, 10, 11
Coramba A. Society	H. E. Hindmarsh	,, 14, 15
Southern New England P. and A. Association (Uralla)	H. W. Vincent	,, 14, 15, 16
Ulladulla A. and H. Association (Milton)	R. F. Cork	,, 15, 16
Nepean District A. H. and I. Society (Penrith)	C. H. Fulton	,, 16, 17, 18
Dapto A. and H. Society	J. J. Cook	,, 17, 18
Wyong District A. Association	C. H. Chapman	,, 17, 18
Rydal A. H. and P. Society	S. B. Prior	,, 18
Guyra P. A. and H. Association	P. N. Stevenson	,, 21, 22
Moruya A. and P. Society	H. P. Jeffery	,, 22, 23
Dorrigo and Guy Fawkes A. Association	A. C. Newman	,, 22, 23
Newcastle A. H. and I. Association	E. J. Dann	,, 22 to 25
Robertson A. and H. Society	E. S. Martin	,, 22, 23
Dorrigo and Guy Fawkes A. Association	A. C. Newman	,, 22, 23
Tahmoor Branch of A. Bureau	E. S. Key	,, 24, 25
Berry A. Association	J. A. Chessell	,, 24, 25
Tenterfield A. Society	E. W. Whereat	Feb. 28, Mch. 1, 2
Tumut A. and P. Association	T. E. Wilkinson	March 1, 2
Manning River A. and H. Association	R. N. Stow	,, 1, 2
Bega A. P. and H. Society	H. J. B. Grime	,, 1, 2
Braidwood P. A. and H. Association	R. L. Irwin	,, 1, 2
Bellinger River A. Society	J. F. Reynolds	,, 1, 2
Griffith A. Society	E. A. H. Richards	,, 1, 2
Oberon A. P. and H. Association	C. S. Chudleigh	,, 2, 3
Berrima District A. H. and I. Society	W. Holt	,, 2, 3, 4
Blacktown and District A. Society	J. M. McMurtrie	,, 3, 4
Yass P. and A. Association	E. A. Hickey	,, 7, 8
Glen Innes P. and A. Society	Geo. A. Priest	,, 7, 8, 9
Kangaroo Valley A. and H. Association	L. W. Vance	,, 8, 9
Bowraville A. Society	H. C. Newnham	,, 9, 10
Taralga P. and H. Association	J. J. Kearney	,, 9, 10
Campbelltown A. Society	J. T. Deane	,, 10, 11
Gundagai P. and A. Society	A. J. Fuller	,, 14, 15
Mudgee A. P. H. and I. Association	S. H. Somerville	,, 14, 15, 16
Armidale and New England P. A. and H. Assocn.	A. H. McArthur	,, 14 to 17
Cobargo A. P. and H. Society	T. McKennelly	,, 15, 16
Barraba P. A. and H. Association	C. E. Williams	,, 15, 16, 17
Wallamba District A. and H. Association (Nabiac)	G. H. O'Connor	,, 16, 17
Luddenham A. and H. Association	L. W. Eaton	,, 17, 18
Coonabarabran P. and A. Association	G. B McEwen	,, 21, 22
Batlow A. Society	C. S. Gregory	,, 21, 22
Tamworth P. and A. Association	F. G. Callaghan	,, 21, 22, 23
Nambucca A. and H. Association	M. Wallace	,, 22, 23
Hunter River A. and H. Association (Maitland)	J. S. Hoskins	,, 22 to 25
Camden A. H. and I. Society	C C. Irving	,, 23, 24, 25
Goulburn A. P. and H. Society	F. D. Hay	,, 23, 24, 25
Richmond River A. H. and P. Society (Casino)	P. M. Swanson	,, 29, 30

AGRICULTURAL SOCIETIES' SHOWS—*continued.*

1922.

Society.	Secretary.	Date.
Upper Hunter P. and A. Association (Muswellbrook)	**R. C. Sawkins**	**April 5, 6**
Cooma P. and A. Association	**C. J. Walmsley**	**,, 5, 6**
Royal Agricultural Society of N.S.W.	**H. M. Somer**	**,, 10 to 19**
East Dorrigo A. Association	T. B. Timms	,, 15, 17
Orange A. and P. Association	G. L. Williams	**May 2, 3, 4**
Narrabri P. A. and H. Association	E. J. Kimmerley	,, 3, 4
Clarence P. and A. Society (Grafton)	**L. C. Lawson**	,, **3, 4, 5, 6**
Hawkesbury District A. Association (Windsor)	**H. S. Johnston**	**,, 4, 5, 6**
Lower Clarence A. Society (Maclean)	E. D. Munro	,, 10, 11
Dungog A. and H. Association	**W. H. Green**	,, 10, 11, 12
Murrumbidgee P. and A. Association (Wagga)	**A. F. D. White**	**Aug. 22, 23, 24**
Corowa P. A. and H. Society	**J. D. Fraser**	,, 29, 30
Cootamundra A. P. H. and I. Association	Wm. A. Sowter	Sept. 12, 13
Holbrook P. A. and H. Society	Jas. S. Stewart	,, 19, 20
Temora P. A. H. and I. Association	A D. Ness	,, 19, 20, 21
Narrandera P. and A. Association	W. H. Canton	,, 27, 28

THE CARE OF POT PLANTS.

PLANTS that are to be cultivated for interior decoration should be put into small plots while quite small, and re-potted into larger ones by easy stages (each time into a richer soil) until they have attained the desired size. During this period they should have the benefit of some congenial atmosphere, in the beginning that of a well-shaded and properly ventilated glass frame, and subsequently that of, say, a bush-house. Not until they are established sufficiently to withstand the artificial conditions obtaining indoors should they be utilised for room decoration.

To replenish the soil with suitable food during the plants' growing period, weekly applications of liquid manure should be given. Aspidistras, palms, hardy ferns, marantas, alpinias, begonias and dracaenas are a few of the plants suitable for indoor decoration.

An important factor in their well-being or otherwise is the manner in which they are watered. The pot should be so filled that the earth can actually absorb a fair proportion of the water given to it. If the soil has been allowed to become so dry that it has contracted from the sides of the pot into a hard ball, it must be soaked by immersing the whole pot in a bucket of water. Pot plants should be watered while they are becoming dry—not when they have become dry to the point of suffering. On no account should they be watered when wet and sodden.

It is not of advantage to pot plants to put them outside in the sun, but they require periodical change to the outer air, shaded from the sun and sheltered from draughts How often they should have this change to outside conditions will depend upon the atmosphere of the room they have been decorating. It should take place not less than once a week if the plants have to contend with gas fumes or draughts, and in some cases the plants should not then be required to do duty again for a month.—E. N. WARD, Superintendent, Botanic Gardens, Sydney.

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Agricultural Gazette of New South Wales.

More Wheat per Acre.

H. BARTLETT, Inspector of Agriculture.

FARMERS who have cropped land continuously to wheat for fifteen or more years often remark that the soil is different from what it used to be—it is more difficult to work, it runs together or cakes more readily, and it will not withstand dry conditions as well as it used to do.

For this condition the main cause is the depletion of the vegetable matter or humus content of the soil.

Humus increases the water-holding capacity of soils, makes heavy soils more friable and easier to work, promotes nitrification, and adds soluble plant-foods to the soil, but it becomes depleted by a process of decay or slow combustion, which is most rapid in hot, dry districts, especially when the land is under bare fallow. As fallowing is essential for the successful production of wheat, and as humus is such an important soil constituent, the problem arises, how is the humus content of the soil to be best maintained.

The sowing about the end of February of winter fodder crops, which may be grazed until the beginning of August, when a growth is allowed to take place which is then ploughed under later in the same month, will undoubtedly give best results. Ploughing under the growth of grass, herbage, and weeds produced between January and July would, perhaps, answer as far as the humus problem was concerned, but would undoubtedly assist in the spread of noxious weeds and other rubbish that would ultimately reduce the wheat yield.

Another method is (when possible) to disc-cultivate or skim plough during January the stubble as left by the harvester, graze with sheep the growth which will take place, and plough during July and August to a depth of 4 to 5 inches (if the soil will allow of that depth), and work as a fallow that is to be sown during the following autumn. If a heavy crop has been harvested it will not be possible to disc-cultivate the land owing to the excessive amount of stubble on the surface, and this must first be got rid of—most conveniently by burning—but there are many seasons when only light crops of straw are produced, and with the aid of stock to thin it out cultivation could be successfully carried out. If the crop has been affected with flag smut or take-all, perhaps the wisest plan in all cases would be to burn the stubble.

The land must be winter-fallowed after the straw is turned under. The wheat plant is not a surface feeder, as is sometimes stated. Many roots reach a depth of 3 or 4 feet; most of the roots, no doubt, appear to be in the first few inches of soil, but they all feed to a depth of at least a foot. If that were not so, how could the plants keep alive during periods of dry weather when the soil is completely dry to a depth of 3 to 4 inches? The fact that the wheat plant is a fairly deep rooter is one of the main factors in the practice of fallowing. With fallowed land the moisture is stored in the subsoil; certainly a large percentage of the moisture rises to the surface by capillarity, but the wheat plant also sends roots through the subsoil, where it obtains not only moisture, but a certain amount of plant-food, though the food is not so abundant there as in the surface soil.

The wheat plant likes a firm seed-bed, and at sowing time the first 2 inches of soil should be loose and dry, and underneath a fairly firm moist seed-bed. This is a condition that can only be produced when land is fallowed. Ploughing to a depth of 4 to 5 inches just prior to sowing is not recommended, as germination is likely to be patchy, owing to variations in the moisture content of the surface soil.

Black Oats.

Black oats throve abundantly during the past year, and were of much moment to numbers of wheat-growers, many having to cut their crops for hay in an endeavour to reap some monetary return. Unfortunately, as prices are low for chaff of such quality, their losses owing to dirty crops will be considerable. Upon some of the larger holdings the "dirty" areas will be used as grazing paddocks for a number of years, in the hope that the pest will be eradicated, but only an optimist could expect clean crops even after four years. The only satisfactory method is to germinate the black oat seeds in the soil as quickly as possible, and the sooner operations are commenced the lighter will be the task. Last season's crop of oats is still on the surface, and the first consideration is to destroy this grain. The grain is covered with fine hairs, which prevent soil and moisture coming into contact with the seed covering unless the grain is completely covered and the moisture content of the soil is sufficient for the vigorous growth of the seedlings. If these protective hairs can be removed a quicker germination will be assured.

Hence it is suggested that as soon as the regulations will permit the stubble should be burned to destroy as many seeds as possible, and burn the hairs of most of those remaining. Then work the surface to a depth of 2 inches as early as possible, thus preparing a suitable seed-bed, and the oats will germinate between April and June. The growth must be kept down with sheep. During July and August break the fallows, and continue to graze and cultivate as occasion demands to maintain a well-worked fallow, and sow the wheat during April or May according to variety. The early cultivation will clean the first 2 inches of surface soil, and the fallow will complete the operation for the remainder of the worked surface. If this method is followed for a few years black oats will not be troublesome, but to neglect the early cultivation and to plough under the surface seeds is surely storing trouble for future years.

TOBACCO grown close to the coast does not, as a rule, burn well—that is to say, will not hold fire.—C. J. TREGENNA, Tobacco Expert.

Field Experiments with Cereals.

Trials at Nyngan Experiment Farm.

G. NICHOLSON, Experimentalist.

A NUMBER of field experiments with wheat were carried out last season at this farm, and although a single season's results can in no case be taken as final, and in some circumstances final decisions must be withheld for several years, the results obtained year by year are always worthy of attention.

Variety Trials with Wheat.

The varieties of wheat under trial last season at Nyngan numbered thirteen, namely, Firbank, Sunset, Plowman's No. 3, Clarendon, Nyngan No. 1, Florence, Gluyas' Early, Hard Federation, Improved Steinwedel, Canberra, Gresley, Sands, and Ecksteen. Two plantings—early and late—were sown of each.

The season may be regarded as a good one, and above the average for Nyngan. The rainfall was fairly evenly distributed throughout the growing period, thus:—Early planting for hay, 9·13 inches; for grain, 9·79 inches. Late planting for hay, 9·70 inches; for grain, 9·99 inches. More rain during the latter part of the season would have improved the grain yield.

This and other experiments are conducted in paddocks running under a triennial rotation. The trials now under review were conducted on a light red loam (typical of the West Bogan country) in paddock No. 6, which had been previously sown with Sudan grass in 1919 and fed off. From July, 1920, until the time of planting a bare fallow was maintained. On 16th July, 1920, the area was mouldboard ploughed to a depth of 6 inches, and turned up in a good open condition suitable for a long fallow. The first cultivation with the disc was carried out on 24th January, and was followed by use of the spring-tooth on 1st March, and another disc-cultivation in April just prior to planting. Apart from an extra spring-tooth cultivation in May of the area planted late, the cultural details for both sowings were identical.

The Early Planting.

Sowing took place on 12th April in a well-prepared moist seed-bed at the rate of 27 lb. of seed with 30 lb. superphosphate per acre. An excellent germination a week after sowing was recorded throughout the trials. Firbank was used on the check plots.

Growth was fairly rapid from the commencement, but heavy frosts in August and September retarded it, frosting some of the earlier varieties severely. Sunset and Plowman's No. 3 were affected the worst, many of the heads failing to produce a single grain. Ecksteen, although early, withstood the frosts very well. All varieties were in ear by the latter part of August. Sunset, Plowman's No. 3, and Ecksteen were outstanding for their earliness, maturing four to five weeks before Firbank. Gluyas' Early, Steinwedel, Sands, and Hard Federation were the last to mature.

Sunset was harvested on 17th August, Eckstéen and Plowman's No. 3 on 26th August, and the remaining plots were cut with the reaper and binder on 21st September. The area left for grain was stripped on 25th and 26th October. Sands and Hard Federation were a little on the green side when stripped.

Very little disease was noticeable; Firbank showed a few heads of loose smut and Florence a little bunt. A minimum of rust (principally spring rust) was present, Canberra and Steinwedel suffering most.

Yields from Early Planting.

Hay.					Grain.		
Variety in Order of Merit.	Yield per acre based on percentage.				Variety in Order of Merit.	Yield per acre based on percentage.	
	t.	c.	q.	lb.		bus.	lb.
Canberra	3	1	2	23	Gluyas' Early	21	53
Gluyas' Early	2	17	3	11	Canberra	20	9
Gresley	2	16	2	1	Gresley	20	9
Clarendon	2	15	0	22	Hard Federation ...	16	59
Nyngan No. 1	2	13	3	7	Clarendon	16	31
Eckstoen	2	13	0	17	Sands	15	3
Hard Federation ...	2	11	2	5	Florence	14	27
Improved Steinwedel ...	2	10	1	22	Nyngan No. 1	14	19
Florence	2	8	2	8	Improved Steinwedel ...	11	35
Sands	2	2	1	9	Plowman's No. 3 ...	7	33
Plowman's No. 3 ...	1	17	0	10	Eckstoen	5	0
Sunset	1	7	2	23	Sunset	3	41
Firbank (check, average of all plots).	2	15	0	22	Firbank (check, average of all plots).	13	23

The Late Planting.

Late sowing took place on 16th May, at the rate of 35 lb. seed, with 30 lb. superphosphate per acre. The ground was in good condition at time of planting, with a dry seed-bed. A good fall of rain resulted in a strong germination throughout the plots on 1st June.

During the early stages of growth it seemed probable that the late planting would outstrip the earlier one, but most of the varieties failed to make much headway after heading. Poor patches which are characteristic of this soil, were very noticeable, and materially reduced the yield. Sunset stood out distinctly from the commencement, and matured earlier than any of the others. Plowman's No. 3, Eckstoen, and Sands were also early, the remainder of the varieties maturing from twelve to twenty days later.

All the hay plots were cut with the reaper and binder on 17th October, and the portion reserved for grain was stripped on 14th November. All the varieties were very dry when stripped, and Sunset, Gluyas' Early, and Florence shelled a little. Sands, Hard Federation, and Canberra held their grain well. It is interesting to note that although the hay yields were lower than in the early planting, the grain yields were higher and of better quality. Frost-bitten heads no doubt helped to reduce the yield in the early plots.

Yields from Late Planting.

Hay.					Grain.		
Variety in Order of Merit.	Yield per acre based on percentage.				Variety in Order of Merit	Yield per acre based on percentage.	
	t.	c.	q.	lb.		bus.	lb.
Sunset	2	2	0	6	Canberra	27	54
Canberra	2	0	0	20	Hard Federation ...	22	42
Nyngan No. 1	1	19	3	22	Sands	22	36
Eckstéen	1	17	2	15	Eckstéen	21	54
Plowman's No. 3 ...	1	17	0	2	Gluyas' Early	20	12
Florence	1	16	1	0	Improved Steinwedel ...	20	...
Gresley	1	15	3	12	Sunset	19	24
Clarendon	1	15	0	27	Plowman's No. 3 ...	19	12
Improved Steinwedel ...	1	14	2	27	Florence	18	54
Sands	1	14	1	8	Nyngan No. 1	16	6
Hard Federation ...	1	14	0	22	Gresley	16	48
Gluyas' Early	1	12	3	3	Clarendon	15	...
Firbank (check, average of all plots).	1	18	2	2	Firbank (check, average of all plots).	20	24

Notes on the New Varieties Tried.

Several of the varieties tried are new or little known, and the following few notes on them will be of interest.

Clarendon.—The variety gave very satisfactory results this season. It is one of the most promising hay wheats grown at Nyngan; the straw is of excellent length, clean and strong; produces a medium yield of grain of good quality. Being a midseason maturing variety, it is suitable for late planting.

Nyngan No. 1.—A selection from Clarendon, the two varieties are practically identical.

Sands.—A late maturing variety, more suitable for grain than hay. It is related to Hard Federation, and is not unlike that variety in habit of growth, being slightly earlier. The brown heads are rather a disadvantage for the production of first-class chaff. The straw is short, but weighs heavy.

Eckstéen.—A very early maturing variety, suitable for late planting. Gives a fair grain yield, but the heads are heavily bearded, a disadvantage in a district such as this, where wheat is usually grown for the production of hay. The straw is flaggy, and inclined to be weak, and the grain is held very loosely.

Plowman's No. 3.—Not quite as early as Sunset; produces a greater length of straw, but does not stool so well. The heads are large and brown in colour when ripe, and produces a good sample of grain.

Gresley.—Gives best results when planted early, maturing a little later than Firbank. The straw is of good quality and of medium length; weighs heavy; a good grain yielder when planted early. Gresley, being a good dual-purpose wheat, is suitable for Nyngan district.

Gluyas' Early.—The name is rather misleading, for this wheat ripens about the same time as Hard Federation. A very fine stemmed wheat, stools strongly, and straw fairly long. Gives a good yield of hay and grain, which entitles it to a place in further trials at Nyngan.

Cultivation Experiments.

With a view to testing the effect of various mulches on the wheat crop, a cultivation experiment was commenced on this farm in 1911 and concluded in 1919. A new series of trials, on a design largely suggested by the results of the preceding ones, was commenced last year. The experiment includes a smaller number of plots (each 1 acre in area), which are being treated as follows:—

No. 1 (*Check*).—Long fallow. Ploughed in July or August. Mulched in the new year when required.
No. 2.—Long fallow. Ploughed July or August. Mulched after rain of any magnitude and onwards.
No. 3.—Long fallow. Ploughed July or August. Mulched once only, when most necessary.
No. 4 (*Check*).—Same as No. 1.
No. 5.—Short fallow. Ploughed after rain of any magnitude in the new year, and mulched when necessary.
No. 6.—No fallow. Ploughed just prior to planting. No mulch.
No. 7 (*Check*).—Same as No. 1.

For the Nyngan district last season's rainfall may be regarded as good, 9·27 inches falling during the growing season; the distribution was fairly even, with heavy falls early in the season. The long fallowed plots, ploughed in July, 1920, received 17·82 inches on the worked fallow. The short fallowed plot, ploughed in February, received 2·56 inches on the worked fallow.

Grain sorghums occupied the ground during the summer of 1919-20. As in other experiments, a triennial rotation is practised. All the long fallowed plots (Nos. 1, 2, 3, 4, and 7) were mouldboard ploughed on 26th and 27th July, 1920. The soil turned over in a dry condition, but in a good friable state suitable for a long fallow. The short fallowed plot was mouldboard ploughed on 22nd February. There was a fair amount of dead grass present, but this turned under well, and the soil turned up in good and fairly moist condition. The non-fallowed plot was mouldboard ploughed on 20th April, turning dry and very open.

The checks (Nos. 1, 4, and 7) were disc cultivated on 4th February, five days after rain of any quantity had fallen. On 24th February, three days after 146 points of rain, the spring-tooth cultivator was used. Block No. 2 (long fallow, mulched immediately after rain of any magnitude and onwards) was first cultivated with the disc on 29th November, following on a fall of 27 points. Two further cultivations were carried out during

February on the same dates as the check plots. The long fallowed plot, mulched once only, was cultivated with the spring-tooth on 25th February. The short fallowed plot, ploughed in February, was cultivated only once (25th February).

The whole experiment was rolled previous to sowing, at which period the condition of the plots was as follows:—

No. 1 (*Check*).—A good mulch with small cloddy surface; firm underneath.
No. 2.—Better mulched than any of the others; fine and firm, and moist beneath the surface.
No. 3.—Open and rough, but improved after the roller had been used.
No. 4 (*Check*).—Same as No. 1.
No. 5.—Moist underneath, with a cloddy surface.
No. 6.—Very rough and dry at planting time.
No. 7 (*Check*).—Same as No. 1.

The experiment was sown on 22nd and 23rd April with Firbank wheat at the rate of 35 lb. per acre, superphosphate being applied at 30 lb. per acre. A patchy germination resulted in all plots on 4th May. Six days later germination in blocks 2, 3, and 5 was complete, and the crops were all growing strongly. The patchy germination was most marked in the non-fallowed plot, complete germination not taking place until the end of the month. From the commencement Nos. 2, 3, and 5 made vigorous growth, and were well ahead of all the others. The checks made very uniform growth throughout the growing period. During the early part of August all plots made excellent growth. A little difference in the time of maturity was noticeable, Nos. 2, 3, and 5 being a few days earlier. All plots were well out in head by the latter part of August. The experiment was cut with the reaper and binder on 4th and 5th October.

Block No. 2 presented the best appearance, making the tallest growth and producing large heads. Later germinating patches produced a superior sample of hay, being quite as tall, finer in the stalk, and not so flaggy. A marked contrast between the short fallowed plot and the non-fallowed plot was noticeable, the former growing to a good height and producing large heads, and the latter patchy and very flaggy.

The yields were as follows:—

Treatment in Order of Merit.	Yield per acre.				Increase over Checks.			Value of Increase.			Cost of Increase.		Net Gain		
	t.	c.	q.	lb.	c.	q.	lb	£	s	d.	s.	d.	£	s.	d.
No. 2 (long fallow and long mulch).	3	7	2	3	16	2	20	2	18	0	2	6	2	15	6
No. 5 (short fallow and mulch)...	3	3	2	1	12	2	18	1	14	3	*2	6	1	16	9
No. 3 (long fallow and one mulch)	2	17	1	1	6	1	18	1	2	5	*2	0	1	4	5
No. 6 (no fallow and no mulch)...	2	8	1	6		†			†		†			†	
Long fallow, mulch in New Year when required (average of checks)	2	10	3	11		....			......		......			......	

* This treatment actually cost less than the checks by the amount stated.

† This treatment resulted in a decrease of 2 cwt. 2 qrs. 5 lb., worth 8s. 11d. The cost of the treatment was 4s. 6d. less than the average cost of the treatment on the checks, and the net loss therefore 4s. 5d.

The valuations upon which the figures are based were as follows:—Hay at £3 10s. per ton; spring-tooth cultivation, 2s. per acre; disc cultivation, 2s. 6d. per acre.

The above records go to show that even in a year with a fair rainfall fallowing increases the yield. Last season's results favour the short fallow rather than the long when only one cultivation is given.

Quantity of Superphosphate to Use.

Experiments to determine the quantity of superphosphate that could be profitably sown with wheat were commenced in 1912. Quantities varying from 20 lb. to 60 lb. per acre were tried.

Last season the plots were sown on 13th April, and the growth throughout was very uniform. The results were slightly in favour of the heavier applications, but the averages of the results since the inception of the trial shows very little difference between the various quantities. Sufficient data has now been obtained to justify the conclusion that 20 lb. to 30 lb. per acre is the most payable quantity of superphosphate to use with wheat in this district.

Rate of Seeding.

A rate of seeding experiment was carried out last season, sowings of 12 lb. to 60 lb. seed per acre being compared. The experiment was commenced in 1919, prior to which season experiments had been conducted with much lighter rates of seeding. The 1919 crop was a failure owing to drought. The years 1920 and 1921 were years of good rainfall, favouring heavy sowings, which proved slightly superior in each case. No conclusions can be drawn until the experiment has been carried on long enough to allow the different rates to be compared over several good and bad seasons.

Trials at Trangie Experiment Farm.

M. J. E. SQUIRE, Experimentalist.

VARIOUS experiments (including experiments with oats) were commenced at this farm during the season 1921. The soil of the area devoted to the trials is a red loam of drift formation, and is typical of the district. Originally covered with box and cypress pine, it was first brought under cultivation in 1916. Stubble from the previous wheat crop was burnt off in January, 1921, and ploughing then took place. Two spring-tooth cultivations were subsequently given after rain on 19th March and 16th April, which brought the seed-bed into excellent condition for planting.

With the exception of extreme temperatures in July and August, the season was normal for the district. The rainfall was as follows:—

January (4 wet days)—232 points.
February (4 wet days)—64 points.
March (3 wet days)—120 points.
April (8 wet days)—345 points.
May (6 wet days)—210 points.
June (7 wet days)—325 points.
July (5 wet days)—195 points.
August (2 wet days)—63 points.
September (3 wet days)—121 points.
October (2 wet days)—60 points.
November (2 wet days)—42 points.

A total of 998 points of rain fell during the growing period. Very little cold weather was experienced until the end of June, with the result that all early plantings made very rank growth. Rust (*Puccinia graminis*) and wheat mildew (*Erysiphe graminis*) made their appearance, but no damage was done, as the attacks were only slight.

Extremely cold weather was experienced at the beginning of August, after which the stems of wheat of all experiments that were sown early were noticed to have turned black between the first and second nodes. Later some of the stems began to split and flatten, and in severe cases break off. The early maturing varieties suffered most, and lodged badly. A sample and full particulars were forwarded to the Biologist, who subsequently reported that the specimens had been kept under observation for fourteen days without the development of anything likely to be responsible for the condition. The opinion was expressed that frost was apparently the main factor contributing to the breakdown of the stems.

Wheat Variety Trials.

The wheat variety trials for grain included Canberra, Hard Federation, Clarendon, Plowman's No. 3, Federation, Gluyas' Early, Improved Steinwedel, Ghurka, and Sands; those for hay included Fairbank, Improved Steinwedel, Bomen, Gresley, Warren, Gluyas' Early, and Florence. The experiment last season was carried out on a third of an area that is to be worked on a triennial rotation of wheat, oats for fodder, and bare fallow. Thus the experiment will always be planted on bare fallow, and will occupy the same ground once in three years. The plots measure one-eighth of an acre.

Early plantings were made both for grain and for hay, but owing to the incidence of heavy storms the midseason sowings for grain were made on varying dates, so that the results are not comparable, and are not included in the published report. The early plantings were sown at the rate of 42 lb. of seed per acre, and the midseason plantings at the rate of 52 lb., superphosphate being applied at the rate of 45 lb. per acre in each case.

In the grain section the early planting was made on 21st April. Plowman's No. 3 came into ear on 21st July, and was killed off by frost. Clarendon started to come out in ear on 2nd August, but the frost killed all heads that had started to appear and checked their growth, so that no further heads appeared until a fortnight later. Ghurka was badly affected by frost, all the straw breaking right off between the first and second nodes. Sands was also badly affected. All varieties were more or less affected by the frost, Federation and Hard Federation suffering least. Plowman's No. 3, Ghurka, and Sands made a fair amount of second growth. In the midseason sowings all plots with the exception of Plowman's No. 3, Ghurka, and Sands, germinated well. The midseason planting looked very healthy throughout the growing period, and ripened more evenly than the early planting.

Excellent weather was experienced during harvest. Both the early and midseason plantings were harvested on 16th and 17th of November.

In the hay section the early plantings were made on 22nd April. The midseason planting, owing to wet weather conditions, was not sown until 2nd June, and should be termed a late planting. All plots germinated well. In the early plantings all plots were affected by the frost, Warren, which was affected the worst, being very badly broken down. When harvested all varieties of this planting were past their best, with the exception of Bomen, which was much later, shorter in straw, and very flaggy. All plots were harvested on 26th September. In the midseason planting each plot was cut shortly after flowering.

The yields were as follows:—

Hay.								Grain.		
Early Planting.				Midseason Planting				Early Planting.		
Variety in Order of Merit.	Yield per acre based on percentage.			Variety in Order of Merit.	Yield per acre based on percentage.			Variety in Order of Merit	Yield per acre based on percentage	
	t.	c.	q.		t.	c.	q.		bus.	lb.
Bomen	2	9	3	Florence ..	1	13	3	Hard Federation	35	9
Florence... .	2	6	3	Bomen	1	13	1	Federation ...	28	6
Gresley	2	6	3	Gresley	1	12	0	Clarendon	23	6
Gluyas' Early ...	2	0	0	Gluyas' Early ...	1	10	0	Gluyas' Early .	14	9
Imp. Steinwedel	1	17	0	Warren ...	1	10	0	Plowman's No. 3	12	4
Warren	1	12	0	Imp. Steinwedel	1	7	0	Sands . ..	11	5
								Ghurka	8	4
Average of checks (Firbank)	2	5	0	Average of checks (Firbank)	1	18	1	Average of checks (Canberra) . .	18	2

Oats Variety Trials.

The object of this experiment is to determine the most suitable variety of oats to grow for hay in this district. This experiment is being carried out on the blocks referred as being worked on a triennial rotation. The varieties under trial were Sunrise, Lachlan, Kelsall's, Quandong, and Mulga, early and midseason plantings being made of each.

The early planting was sown on 23rd April at the rate of 44 lb. of seed per acre, and the midseason planting on 3rd June at the rate of 49 lb., superphosphate being applied at the rate of 70 lb. per acre in all cases. As in the wheat variety trials, the midseason planting should be termed late, wet weather preventing the carrying out of seeding operations at the proper time.

All the plots germinated well. The early planting made very rank growth in the early stages, and all varieties grew very coarse, with the exception of Kelsall's, which was rather fine in the straw, at the same time standing up well. Lachlan and Quandong were very flaggy, and much later maturing than Sunrise.

The yields were as follows:—

Early Planting.				Midseason Planting.			
Variety in Order of Merit.	Yield per acre based on percentage.			Variety in Order of Merit.	Yield per acre based on percentage.		
	t.	c.	q.		t.	c.	q.
Mulga ...	3	8	0	Mulga ...	1	16	1
Kelsall's ...	2	19	3	Kelsall's ...	1	15	2
Quandong ...	2	17	1	Lachlan ...	1	15	1
Lachlan ...	2	12	0	Quandong ...	1	8	2
Average of checks (Sunrise)	3	3	3	Average of checks (Sunrise)...........	1	17	1

ARSENITE OF SODA THE BEST DEFENCE AGAINST GRASSHOPPERS.

SINCE last September numerous reports have reached the Department of large swarms of baby grasshoppers hatching out from egg patches in many centres, particularly in the Hunter Valley. A close survey was accordingly made, and landowners were organised for combined effort in combating the locusts, particularly by means of spraying with arsenite of soda.

As evidence of the efficacy of the control measures recommended by the Department, the experience of Messrs. H. E. A. and V. White may be quoted. Messrs. White control an area of 30,000 acres at Belltrees, and of this 5,000 acres were badly infested. Spraying was undertaken with a mixture of 1 lb. arsenite of soda, 4 lb. molasses, and 16 gallons of water, and although this treatment was temporarily abandoned in favour of petrol and kerosene in the early stages of the attack. it was soon reverted to as the more economical measure. The arsenite of soda and molasses were used thenceforward until the necessity for combative measures disappeared.

Direct spraying with the arsenite solution was attended with marked success, and altogether some hundreds of hatching patches were treated, involving the use of about 3,000 gallons of poison mixture, which was applied with bucket spray pumps, care being taken to spray under logs and among thistles and other material that might afford shelter. Messrs. White recently reported that no hoppers were to be found on their estate, although they were in millions a few miles away.—W. W. FROGGATT, Government Entomologist.

THREE ENGLISH WHEATS.

JOHN Bull, Pedigree Snowdrop White, and Harvester, three English varieties of wheat received recently for trial, were planted at the beginning of May last year at Cowra Experiment Farm, alongside Hard Federation. The local variety started to head six weeks ahead of the imported varieties; the latter are much too late, and in drier years would form scarcely any grain. This is the usual experience with English varieties of wheat. Yeoman and Fenman are two other English varieties which were proved, by recent trials, to be similarly unsuitable.—J. T. PRIDHAM, Plant Breeder.

EXPERIENCE AT CONDOBOLIN EXPERIMENT FARM.

UNTIL quite recently Condobolin was regarded as outside the wheat belt, but the Department of Agriculture, unready to accept that opinion, a few years ago established in the district a demonstration farm, which has more recently been renamed Condobolin Experiment Farm.

Although during the last few years the State has passed through some exceptionally severe droughts, a complete failure has not yet been experienced on this farm, at least sufficient for seed and feed purposes having been produced each year, which is more than could be said by many farmers in much more favoured localities. Success has been due to thorough fallowing, early sowing, selection of varieties suitable to the district, and the use of superphosphate. The season just ending was by no means favourable, the rainfall being below normal, as the following table shows:—

January, 1921	Nil.	June	291 points.
February	35 points.	July	40 ,,
March	150 ,,	August	70 ,,
April	153 ,,	September . .	121 ,,
May	168 ,,	October	69 ,,

The following table shows the yields from different varieties:—

	No. 1 Paddock.	No. 3 Paddock.	No. 5 Paddock.	Total Yield.	Average Yield per Acre.
	acres.	acres.	acres.	bushels.	bushels.
Red Wings wheat	10	... ..	......	150	15
Billy Hughes	14	....	......	252	18
Hard Federation	14	.....	......	54	13½
Canberra	14	.....	.....	308	22
Improved Steinwedel	20	.....	......	290	14½
Firbank	20	... .	......	420	21
Clarendon	3	... ..	... ..	39	13
Ghurka	3	......	...	72	24
Sunset	3	......	......	36	12
Florence	1	......	... ..	18	18
Canberra	. ....	35	.....	18	18
Sunrise oats	......	......	7	147	21

An area of 160 acres of wheat was cut for hay, and yielded 160 tons, while 90 tons for silage were cut from 30 acres of wheat.

The method of cultivation followed is a thorough one. The land is broken up immediately after seeding is completed, and worked with the spring-tooth cultivator as required during the period between ploughing and the following seeding. The summers are usually moderately dry, and about three cultivations are sufficient; the soil is fairly light, and therefore easily worked.

Early sowing is practised, and seeding is usually finished by the end of May. Later sowings invariably give low yields. Superphosphate makes a big difference in the yields, but only a small quantity is required. Applications of about 45 lb. per acre have been found most suitable.

As the above list of varieties indicates, only early maturing wheats are suitable. Later varieties are not now sown.

The most suitable sorts are Canberra and Firbank, and in the future those will be principally used. Canberra gives the best grain yield, but Firbank also returns good crops of grain as well as of hay.—E. W. KENNEDY.

Farmers' Experiment Plots.

WINTER GREEN FODDER TRIALS, 1920-21.

Murrumbidgee Irrigation Areas.

A. N. SHEPHERD, Assistant Inspector of Agriculture.

WINTER green-fodder trials were carried out last season with the co-operation of the following farmers:—

H. Booth, Farm 854, Whitton.
Briggs Bros., Farm 815, Leeton.
Houghton Bros., Farm 918, Leeton.
W. Edwards, Farm 367, Leeton.
H. Phillipson, Farm 905, Griffith.

The soils at the above centres may be said to include all the main classes of soils that occur on the area. Light rains fell during the autumn and gave the crops a good start, but the rainfall then began to fall off, and as no irrigation water was available the crops were not as heavy as if they had received even one watering. The rainfall registrations at Leeton were as follows:—April, 1·22 inches; May, 1·79 inches; June, 2·57 inches; July, 0·54 inches; August, 1·63 inches. It is interesting to review these records in relation to the readings of evaporation from a water surface during the same months, viz.:—April, 2·85 inches; May, 2·03 inches; June, 1·02 inches; July, 1·41 inches; August, 1·44 inches. Examination of the second lot of figures makes one quickly realise the necessity for thorough farming methods for the conservation of soil moisture, for at this period of the year, in normal seasons, water rotations for irrigation have practically ceased.

The first frost (a slight one) occurred in April, and was followed by fifteen in June, whereas the previous year there were five in April and seventeen in May, followed by good rains.

Details of the Plots.

Farm 854.—Red clay loam; a heavy type of soil, but one that responds to good cultural methods. Previous crop (1920) hay, fertilised with 70 lb. superphosphate per acre. Ploughed March, and irrigated and cultivated the same month. Check banks put in for irrigation later, if necessary, and if water available. Sown 4th April (wheat and barley 1 bushel per acre, oats 1½ bushels, vetches 20 lb.). The plots germinated very well, and, thanks to the irrigation previous to sowing, made rapid growth. A cut could have been made of some of the plots in July, but cutting was delayed until the end of August, so as to obtain the heaviest yields. Sunrise oats, together with Cape barley and vetches, gave the best yields.

Farm 815.—Red sandy loam. Previous crop oats, fertilised with 70 lb. superphosphate per acre. Ploughed and irrigated March, and cultivated and harrowed previous to sowing, which took place on 15th April, at same rate as on farm previously mentioned. The germination was very good, Skinless barley making very rapid growth. The plots harvested first (Thew, Firbank, and Florence wheats, and Skinless barley) were cut on 2nd September; the others were harvested a fortnight later.

Farm 918.—New land not previously watered. Owing to delay in channel construction it was impossible to water the plots when required, and yields were consequently reduced. Sown on 19th March, a good germination was obtained, but in April the plot was practically eaten out by grasshoppers, the wheat sections being so badly attacked that they failed to recover.

Farm 367.—Manurial trial with Florence wheat. Red clay soil. Previous crop (1919) Sudan grass. Ploughed spring, 1920; cultivated and ploughed February, 1921; double disced and cultivated March. Sown 30th March (1 bushel per acre). This plot gave promise of a good yield until attacked by the grasshoppers, and even then recovered after being irrigated, and yielded satisfactorily. It was cut and weighed on 5th August.

Farm 905.—Manurial trial with Cape Barley. Good class sandy loam. Sown 12th April, 1921. The land had received a long fallow and was in splendid condition at seeding time. The crop came away well and made rapid growth, being harvested at the beginning of September.

RESULTS of Variety Trials.

Crop.	Farm 854.				Farm 815.				Farm 918.			
	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.
Cape barley and vetches ...	13	2	3	12	....				6	19	2	16
Sunrise oats	12	19	3	18	11	8	2	8	6	8	3	20
Guyra oats	12	14	0	2	11	17	4	16	....			
Firbank and vetches ...	10	5	2	24	....				....			
Cape barley	10	2	3	2	8	11	1	20	6	5	2	6
Firbank wheat	8	4	1	4	6	3	2	8	....			
Skinless barley	7	14	1	4	8	0	0	0	....			
Thew wheat	5	2	3	12	5	10	0	0	....			
Florence wheat	....				7	0	1	12	....			
Warren wheat	....				7	17	0	16	....			
Sunrise and vetches... ...	....				....				7	0	0	0

RESULTS of Manurial Trials.

Fertiliser per acre.	Farm 367 (Florence wheat).				Farm 905 (Cape barley).			
	t.	c.	q.	lb.	t.	c.	q.	lb.
*M5, 106	6	8	2	8	8	18	2	8
Superphosphate, 140 lb. ...	6	1	1	20	8	3	3	12
Superphosphate, 70 lb. ...	5	9	1	4	7	8	2	8
*M6, 112 lb.	5	4	0	12	9	17	0	16
No manure	8	0	0	4	6	8	2	0
*M7, 92 lb.	....				12	5	2	24

* The fertiliser mixtures are made up as follows:—M5, 2 parts superphosphate and 1 part sulphate of ammonia; M6, five parts superphosphate and three parts chloride of potash; M7, ten parts superphosphate and three parts chloride of potash.

Summary.

One cannot help coming to the conclusion, after considering the above results, that by the inclusion of vetches with the cereal the crop weight is increased; a better balanced ration is also obtained. These results coincide with those obtained last year. Points especially in favour of oats are that they will stand rougher treatment, grow better on heavier soils, and stand much more water. This is especially noticeable where the land after irrigating is inclined to "puff," thereby leaving slight depressions in places where water may lodge. If oats are sown early a cut can be taken off during the winter and fed green, and then a good cut of hay obtained later. This refers chiefly to the early-maturing varieties, such as Sunrise.

From the manurial trials one draws the conclusion very definitely that the application of fertiliser results in much heavier yields, but soil and other inevitable variations make the determination of the most profitable fertiliser largely a matter for experiment by the individual farmer.

WINTER FODDER TRIALS AT GLEN INNES.

A WINTER fodder trial was conducted at Glen Innes Experiment Farm last season, the following crops coming under observation:—Algerian oats, Grey field peas, Dwarf Essex rape, Purple Top Aberdeen turnips, Cape barley, Black Winter rye, Perennial red clover, and peas and rape, peas and wheat (Genoa), and peas and barley. The plots (one-fifth of an acre each) were planted in March, and an exceptionally wet winter interfered with the results to such an extent that definite conclusions cannot be drawn. Growth was very slow and the ground remained very wet, so that the plots could not be harvested until late spring, so that the yields can hardly be regarded as winter fodder.

The results indicate that for this district the growth of rape, peas (and the mixtures including peas) and clover is too slow, and they cannot be compared with oats, barley, rye, and turnips for the purpose.

The trial will be continued in its present form with the object of obtaining the relative values of the different crops as disclosed by results of a number of trials.—L. G. LITTLE, Experimentalist.

POTATO BREEDING IN UTAH.

THROUGH a system of potato selection, whereby all strains were eliminated whose progeny for three to five years did not give yields of standard excellence, it has been possible to breed up a strain that has given as a six-year average a yield more than 60 per cent greater than that for unselected seed—307·0 and 190·7 bushels an acre, respectively. The high producing strain sets 18 per cent more potatoes to the hill, and the average size of the tubers is 24 per cent. larger than for unselected. The germination of the selected strain is more rapid, the stand is better, the growth thriftier, and disease less apparent than for the unselected potatoes.—Circular No. 46, Utah Agricultural College Experiment Station, U.S.A.

DEPARTMENTAL VARIETIES TRIED AT CURRABUBULA.

DURING the past season variety trials with wheat, oats, and barley were conducted by Mr. A. E. Weakley on his farm near Currabubula in the Gunnedah district. The seed for the plots was supplied by the Department, and Mr. Weakley recently furnished an interesting report, from which the following is extracted:—

The soil consists of a sandy loam, varying from light to dark, and overlaying a red clay subsoil at a depth of about 12 inches. The land had been under cultivation for about fifteen years. The previous crop failed owing to drought, and the land was not cultivated during the 1919–20 season. It was disc-ploughed 4 inches deep during the last week in February, 1921 (being then very dry and hard), cultivated with spring-tooth cultivator on 20th April, and the seed drilled in on the same day, every other run of the drill being stopped. The yields per acre were:—

	bus.	lb.		bus.	lb.
Hard Federation wheat (*check*) ..	14	12	Guyra oats	38	0
Yandilla King..		*	Algerian .. .	56	0
Currawa	26	30	Sunrise	25	8
Improved Steinwedel ..	21	0			
Gresley	19	11	Skinless barley . .	7	15
Bomen	24	18	Cape ..	49	15
Florence	4	24			

For some unknown reason Florence wheat and Skinless barley made poor growth in comparison with other plots, due possibly to excess of moisture during the winter and consequent souring of the soil. Hard Federation, a variety that gives consistently good results in the district, was selected for the check plot. The plots were generally very healthy, though weeds got an almost equal start with the grain, and in August and September seriously competed for the moisture in the soil.

The results afford undeniable evidence that the varieties grown by the majority of farmers in the district are inferior yielders compared with those recommended by the Department.

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* The trap door of the elevator was inadvertently left open during the harvesting of Yandilla King. I promised to yield quite as well as Bomen or Currawa.

A WHEAT-GROWING QUERY.

A HOLDER of a grazing property in the Wee Waa district, who contemplated growing wheat, in the event of the land being considered suitable by the Department, forwarded a sample of soil for analysis. The geological formation of the surrounding country is alluvial (black soil plains), and the sample of soil submitted proved to be a heavy black loam, which was said to extend to a depth of 10 to 12 inches. It was alkaline in reaction, and on being wet and dried caked into hard lumps. The water percolation was good, and the nature of the subsoil was described as being similar to that of the surface.

The correspondent was informed that although the chemical quality of the soil indicated a capacity to produce wheat successfully, departmental experience with that class of soil prohibited the recommendation that any effort should be made to grow the crop for grain to any extent, though it would be worth while growing it for hay. Such soil produced a heavy rank growth, which burnt off quickly in the early summer, preventing the development of grain; in damp seasons, on the other hand, the rank growth was very susceptible to rust, so that only on rare occasions were climatic conditions suitable for the production of grain. For the best results the crop should be sown early (about April), and, if necessary, fed off, to prevent risk of lodging. Quick-maturing varieties, such as Florence, were recommended.

Bushel Weights of Sorghum and Sudan Grass Seed.

J. N. WHITTET, Assistant Agrostologist.*

THE bushel weights given hereunder were obtained from seed produced during the 1920-21 season, and give some indication of the average weights that could be expected in a fairly good season from sorghums and Sudan grass. In round figures the weight per bushel of the varieties can be taken as follows :—

	Lb. per Bushel.		Lb. per Bushel.
Milo	57	Early Amber Cane	47
Feterita	56	Saccaline...	56
Manchu Kaoliang	56	Selection No. 61	50
Sudan grass	43		

Bushel weights of some of the above varieties are available from the United States of America, and our weights compare very favourably with them. The extremes in American legal weights per bushel for all sorghums range from 30 to 57 lb., Milo and Kafir range from 50 to 60 lb., and Early Amber Cane from 45 to 60 lb. No weights are available for Sudan grass.

	Grain Sorghums			Sweet Sorghums.			Sudan Grass.
	Milo.	Feterita.	Manchu Kaoliang.	Early Amber Cane.	Saccaline.	Selection No. 61.	
	lb.	lb.	lb.	lb.	lb.	lb.	lb.
Cowra Experiment Farm ...	61½	61	57¾	...	...	...	47½
Coonamble Experiment Farm	60½	...	61¾	...	...	...	...
Bathurst Experiment Farm	59½	53¼	55½	48	...	...	45
Wagga Experiment Farm ...	50¼	54¾	48¾	47½	...	...	43¼
Nyngan Experiment Farm ...	55¼	54½	56	45½	...	...	38½
Berry Experiment Farm ...	...	...	...	...	...	49¼	...
Wollongbar Experiment Farm	...	...	...	...	51¼	...	...
Grafton Experiment Farm ...	...	...	...	...	54	51¾	...
Glenfield Veterinary Farm ...	...	...	...	...	60¼	...	...
Hawkesbury Agricultural College, Richmond.	...	...	...	...	58¼	...	43¾
Average weight per bushel ...	57·4	55·9	55·95	47	55·94	50·5	43·6

Remarks on the Different Samples.

The following comments on the different samples from the various farms are of interest :—

Cowra Experiment Farm.—Milo : excellent quality seed, few cracked grains. Feterita : seed a trifle small, no cracked grains. Manchu Kaoliang : seed of good quality. Sudan grass : sample of excellent quality.

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* The weighing of the sorghum and Sudan grass samples was carried out by Mr. G. W Norris, Milling Investigator of the Chemist's Branch of the Department.

Coonamble Experiment Farm.—Milo: very good quality seed. Manchu Kaoliang: excellent quality seed.

Bathurst Experiment Farm.—Milo: good quality clean seed, no cracked grain. Feterita: very small clean seed, no cracked grain. Manchu Kaoliang: fairly good quality seed, few cracked grains. Sudan grass: well-filled good quality grain. Early Amber Cane: Good quality seed.

Wagga Experiment Farm.—Milo: seed did not clean well; glumes plentiful. Feterita: fair quality small seed. Manchu Kaoliang: poor quality small seed. Sudan grass: well-filled grain of fairly good quality. Early Amber Cane: good-sized grain.

Nyngan Experiment Farm.—Milo: seed variable in size; fair proportion of small grain present. Feterita: majority of seed small. Manchu Kaoliang: seed of fair quality, large proportion of small grain. Sudan grass: seed of inferior quality. Early Amber Cane: fair quality seed.

Berry Experiment Farm.—Selection No. 61: grain of good size and condition.

Wollongbar Experiment Farm.—Saccaline: poor quality, inferior seed.

Grafton Experiment Farm.—Saccaline: grain of good quality. Selection No. 61: grain of good quality.

Glenfield Veterinary Farm.—Saccaline: an excellent sample.

Hawkesbury Agricultural College.—Sudan grass: fairly good quality. Saccaline: grain of very good quality and condition.

TREBLE SUPERPHOSPHATE.

AT the present time Michigan farmers are interested in soluble phosphates, which are now on the market as superphosphate and treble superphosphate. . . . . The treble superphosphate has only recently appeared on the market in appreciable quantities. . . . . It is prepared by treating rock phosphate with an excess of dilute sulphuric acid. The gypsum and other substances are largely removed, and the liquid that remains is concentrated by evaporation, and is then used in treating the highest grades of raw rock phosphates. The result is a soluble phosphate which contains about 45 per cent. available phosphoric acid (in the form of mono calcium phosphate) or about three times as much as "16-per cent. acid phosphate." —H. M. McCOOL, in Michigan Agricultural College Experiment Station *Quarterly Bulletin.*

THE time to begin feeding a dairy calf is before it is born. The great single factor that goes to determine what a calf is to be is the breeding that lies back of it, and the second factor is the way the calf is fed and handled until maturity. The cow feeds her calf during the time of the gestation period just as surely as she does after the birth of the calf. Cows in poor condition give birth to weak calves that are difficult and expensive to raise.—J. E. BURNETT, in Michigan Agricultural College Experiment Station *Quarterly Bulletin.*

Harvest Report, 1921.

NYNGAN EXPERIMENT FARM.

S. RUDKIN, Manager.

THE area planted with wheat last year on this farm was 191 acres, made up of a commercial area of 141 acres and an experimental area of 50 acres. The season was not so good as the heavy summer rains of the previous year would have seemed to promise. Although 9·79 inches fell during the growing period, 7·44 inches of this were registered in May, June, and July. August and September were, as usual, on the dry side. It was decided to cut the bulk of the wheat for hay, and to save only sufficient grain to meet the immediate requirements of the farm, the issue as between a 30-cwt. hay crop and a 15-bushel grain crop being considered to be in favour of the former, reckoning the product at the rate of £3 10s. per ton in the stack. No rain fell between cutting and carting, and the hay obtained is of good quality. The grain is of good quality but slightly pinched.

Details of the Blocks.

The commercial area was allotted as follows:—No. 10 paddock, 107 acres; No. 6, 11 acres; No. 1C, 17 acres; plantation, 6 acres.

Paddock No. 10.—Wheat fed off in season 1918–1919; stubble fed off in 1919–20; ploughed 5 inches with the disc east and west from 23rd August, 1920; fed off with sheep until the new year, when it was cultivated crossways to the ploughing with the disc-cultivator; spring-toothed prior to drilling and harrowed after; planted with the disc drill crossways to the ploughing, using seed at the rate of 35 lb. with 30 lb. superphosphate per acre. The seed-bed was clean, but moisture was present only in patches. The germination was irregular, but the gaps filled up later.

Details of the blocks of this paddock are as follows:—Block 1: Canberra (4·75 acres); planted 13th April; harvested for hay 26th September; stooled heavily, but gave a poor sample. Block 2: Steinwedel (10·8 acres); planted 14th April; harvested for hay 3rd October; hay of good length, but straw broken. Block 3: Hard Federation (9·4 acres); planted 14th April; harvested for hay 3rd October; hay short but heavy. Block 4: Firbank (51·5 acres); planted 15th to 21st April; harvested for hay 27th to 29th September; hay good colour and long. Block 5: Clarendon (21·5 acres); planted 21st to 23rd April; harvested for hay 30th September; hay good quality and very good colour. Block 6: Sunset (7 acres); planted 27th May; harvested for hay 4th October; short but good quality; stripped 1st November, yielding 15 bushels per acre.

Paddock No. 6.—Sudan grass fed off in 1918; ploughed 5 inches with the disc about July, 1920; disc-cultivated 24th January; spring-toothed in March and disc-cultivated just prior to planting. Planted with the hoe drill on 14th April, using seed at the rate of 22½ lb. with 30 lb. superphosphate per acre.

Details of the blocks:—Block B: Clarendon (5 acres); harvested for hay 28th September; originally intended for grain, but owing to patchiness it was decided to cut for hay; hay of excellent colour, which should give first-class sample of chaff. Block D: Clarendon (6 acres); similar to Block B.

Paddock No. ***1C.***—Sudan grass fed off in 1919; ploughed 5 inches deep with disc in August, 1920; disc-cultivated 4th February, 1921; spring-toothed 24th February; spring-toothed again and rolled before planting on 26th April, at the rate of 28 lb. seed per acre.

Details of the blocks: Block 1: Clarendon (9·6 acres); 3 acres cut for silage, 3·2 acres harvested for hay, and 3·4 acres stripped; the best grain crop on the commercial area for the year; hay the best on the farm. Block 2: Firbank (7·4 acres); 1·4 acres cut for silage, 1 acre harvested for hay, and 5 acres stripped; hay of good quality; grain slightly pinched.

Plantation Paddock.—Gresley (6 acres). A spare area in the plantation was fallowed and planted with Gresley wheat on 26th April, 1921. The fallows received only one cultivation just before planting. This is evidenced in the result (1 ton per acre). The sample of hay is of very good quality.

A quantity of bush hay (estimated at 75 tons) was made from paddock No. 18, where some self-sown crop had grown. The hay comprises 50 per cent. wheat and 50 per cent. native grasses, and will make a very good drought fodder for heavy stock. It was taken off 90 acres.

The returns given hereunder for silage and hay are estimates only. The harvest may be regarded as rather better than the average. There is still room for improvement in some of our cultural methods; every year we are up against different climatic conditions, and the experience of previous years is sometimes misleading.

SUMMARY of Returns.

Paddock.	Acres.	Variety.	Yield per Acre.			
			Silage.	Hay.		Grain.
			tons.	t.	c.	bus.
No. 10	4.75	Canberra	.	2	9	.....
,,	7·5	Steinwedel	...	1	7	.....
,,	2·3	,,	..	..		16
,,	9·4	Hard Federation	....	1	5	.....
,,	51·5	Firbank	.	1	10	.....
,,	3	,,	7	...		......
,,	21·5	Clarendon	. .	1	7	.....
,,	4·4	Sunset	....	1	12	. .
,,	2·6	,,	.....	.		15
No. 6	5	Clarendon	....	2	0	....
,,	6	,,	.....	1	17	....
No. 1 C	3	,,	7	...		......
,,	3·2	,,	...	1	18	......
,,	3·4	,,	......	...		19
,,	1·4	Firbank	7	..		......
,,	1	,,	.....	2	0	......
,,	5	,,	. .	...		15
Plantation	6	Gresley	.....	1	0	.....

The total yields on the commercial area were 52 tons silage, 183 tons hay, and 216 bushels grain. The experimental area yielded 48 tons silage, 51 tons hay, and 46 bushels grain.

Hygiene in the Piggery.

THE MAIN FACTOR IN THE PREVENTION OF DISEASE.

W. L. HINDMARSH, B.V.Sc., M.R.C.V.S., D.V.H.

DURING the past few years the pig industry has steadily grown in importance, the value of the individual pig has increased, and farmers have had little difficulty in disposing of their stock.

In spite of the increased value of swine, however, most farmers continue to keep the animals under the haphazard conditions that prevailed when there were few market facilities, and losses from various diseases were felt less than they are now. The following article is not intended to form a compendium of diseases and their treatment, but rather a guide to the precautionary measures to be adopted to ensure freedom from infectious and other complaints commonly encountered. Sickness inevitably spells loss, and health just as certainly depends upon the paying of proper attention to the feeding of the animals and the general conditions under which they are kept.

In too many cases the pig farmer carries out his duties in a perfunctory manner. So long as the pigs are fattening and he is receiving what he considers is a fair price for his stock, he is careless of the conditions under which the stock are housed and fed, apparently not realising that good sanitation and correct feeding will help him to fatten his pigs not only more speedily but at a bigger profit. When he has losses he attributes them to bad luck—never to bad management. Usually he hides the fact that deaths have occurred, for fear his piggery will have a bad name, and it is only when his losses are too severe to be kept hidden any longer that he calls in skilled attention. It is common to find cases where even an elementary knowledge of swine husbandry is lacking. Not quite every farmer fully appreciates even the relationship of quick fattening to good food, for pigs have been found running through uncleared country with little or no shelter, the owners being of opinion that the pigs would fatten on what they could forage in the bush!

For quick returns and for the utilisation of farm products which otherwise would be of little marketable value, pigs stand alone; but an intelligent interest in their welfare, and attention to feeding and sanitation are essential to the best results. The main essentials in the profitable rearing of pigs are (1) early maturity, (2) animals with good fattening properties, and (3) large healthy litters; and these necessitate (*a*) good stock; (*b*) good housing and living conditions; (*c*) correct feeding, and (*d*) careful breeding and treatment of the young.

It is not intended to refer at any length here to the choice of stock. Most breeders are aware of the necessity of having a pure-bred boar of good type and constitution at the head of the herd, and they also recognise the necessity of mating him with sows whose type and constitution indicate power to reproduce good stock. It should not be necessary either to emphasize the need of doing away with scrub animals, and replacing them with pure-bred and grade animals. The question of housing, however, it is desirable to discuss at greater length.

The Necessity of Good Housing.

It is a common custom to put the piggery anywhere out of sight without any reference to hygienic considerations. The sty is usually built out of second-hand bush timber. Often pigs are enclosed in small yards in low-lying situations, with the result that the pigs have little exercise, and the enclosure is soon a quagmire in which the animals sink to their bellies. In damp, cold, changeable weather they have little shelter and suffer in consequence, while the filthy state of their surroundings and the fact that the pens and yards are rarely if ever cleaned out, tends to make infestation by parasitic worms highly probable. Other diseases which may reasonably be expected to result, and which commonly do occur, are nasal catarrh, pneumonia, rheumatism, and paralysis of the hindquarters. Even if the owner is so fortunate as to escape actual disease in his stock, these unhygienic conditions lengthen the period of fattening and tend to hinder the animal's development.

Shelter is essential for pigs. Swine have been so long domesticated, raised under artificial conditions, and bred to turn all their energy to rapid growth and fattening, that they are very susceptible to dampness, cold, draughts, and hot summer weather. There are two main types of piggery commonly in use—(*a*) central houses, containing a number of pens, and (*b*) individual houses, holding but one or more pigs. The former are more convenient and save labour, while the latter are less expensive to erect, are quieter, and can be removed to new ground if necessary, but of whatever type the house may be, attention must be paid to the following points:—

1.—Sties should, if possible, face the north or east, so that they will get the full benefit of the sunlight. Sunlight is a most efficient germicide, and is a great help in keeping the sties sweet and sanitary.

2.—Sties should be built on rising ground to ensure good drainage. This does not necessarily imply that they should be placed on the top of a hill, where the animals would be exposed to every wind that blows.

3.—The roof should be sufficiently high to admit of the sty being cleaned easily. The idea of keeping a pigsty clean is revolutionary to some farmers, but disease and filth are associated as a rule, and cleanliness is essential to the preservation of health.

4.—The walls should be smooth, so that there is no harbour for animal parasites. On this account walls of split bush timber are objectionable.

5.—Allowance must be made for plenty of sunlight and fresh air.

6.—The walls must be impervious to the wind, so that the sty is not draughty.

7.—The floor should be impervious to moisture. The common custom of allowing the pigs to sleep on the earth, while doing away with the necessity of bedding, has much to condemn it. The earth is easily rooted up, is damp and cold in winter, and is soon saturated with filth. Concrete makes the most sanitary floor, but, as it is cold and hard, a sleeping platform of wood is necessary with it. If this is made sufficiently light it is easily removed for the purpose of cleaning the sty. A floor made of hardwood, well joined and raised above the ground level, is quite satisfactory; but floors made of slabs laid on the ground are little better than the earth itself.

If the points enumerated above are attended to the pigs will have dry clean housing in favourable situations, free from draughts, and yet with abundance of fresh air.

The Yards.

The yards should be sufficiently large to enable the pigs to have plenty of exercise. Except in the final period of fattening, when the exercise is restricted, the animals should have a free run. Pigs are far more healthy when grazed in paddocks than when enclosed in pens. Where it is not convenient to run the pigs over large areas, and they are confined to small yards, a system of alternate yards gives good results. Under this system, when one yard becomes foul from constant use by the pigs it can be ploughed or dug up, limed, and a green or root crop sown, the pigs being transferred to another yard. When the crop is up the pigs may be returned to that yard and have the benefit of the food, while the yard just vacated can then be treated in a similar manner. This serves the double purpose of cleansing and sweetening the soil and providing some green food. When the same yards are used for long periods without being rested, the soil becomes the source of infection for various microbic and parasitic diseases. When pigs are grazed over large areas a portable pig-house, built on slides, is very convenient.

During the summer months the provision of shade for pigs is very essential. The ordinary sty, especially if it has an iron roof, is very hot, and some other shade is necessary in the heat of the day. If no trees are present a wooden shed will answer the purpose. Another important aid to the health and comfort of swine is the provision of a bath in which they can lie in hot weather. To wallow in the mud is the pig's natural method of cooling himself, and if the pig-yards have a frontage to a stream, well and good, though there is an objection to pigs wallowing in a stream, in so far that infection may be carried down from diseased pigs higher up the stream, and as a result contagion spread over a wide area. Unfortunately, the hog wallow usually seen on the pig farm consists of a filthy puddle-hole, into which there drains all the urine and dung from the yard, and in the foul mud of this, the only wet spot available, the pigs are compelled to seek relief. If there is infection of any kind in the yard it is to be found in just this place. Such wallows should be drained and filled in, and if there is no naturally clean place for the pigs to be in, a concrete or similar bath should be built in. This can then be kept clean, and the liability to infection from contagious disease will be diminished.

Cleanliness in Relation to Food Utensils.

Most farmers, having formed the opinion that the pig is necessarily a dirty animal, make no attempt to keep the feeding troughs and utensils clean. The usual trough used is made from a hollowed log, a type which it is obviously difficult to cleanse, and the food soaks into the numerous cracks and crevices, putrefies, and ultimately forms a favourable breeding-ground for innumerable germs, which, if taken into the digestive system, may cause disease. In this method of feeding is found the cause of most of the gastro-intestinal derangements encountered in young pigs. Scours and inflammation of the stomach and bowels are usually due to incorrect and filthy feeding. Again, food such as swill, skim-milk, and butter-milk, which is stored in old tanks, casks, and like receptacles, is liable to cause similar trouble if no effort is made to keep the vessels in a sanitary condition. It is no uncommon sight to see the vats encrusted with layers of half-dried decomposing milk, and pipes and gutters conveying the milk coated with a pinkish, slimy deposit, while the milk itself is foul in odour and bubbling with the gas generated by the process of putrefaction. Young pigs are especially liable to suffer from scours, gastritis, and such troubles when fed on such material. The usual argument advanced by the farmer is that clotted milk is better than the sweet milk for feeding: but there is an immense difference between soured milk and the putrid material that is often fed.

Strict cleanliness with regard to vats, troughs, and other feeding utensils is essential. Uneaten food should be removed, and the troughs cleansed before another supply is given. Troughs may be of iron, concrete, or wood. Iron troughs are probably to be preferred, as they can be kept clean with a minimum of trouble. Concrete is good provided it is well made and well finished off. Sour milk has a very destructive action upon concrete, and unless the troughs are made by an expert they will soon break up, and the pigs will eat up the lime and sand with the food. Concrete troughs should be finished off with a thin layer of cement (1 part) and fine sand (2 parts). This should be steel trowelled to give as smooth a surface as possible. Treated in this way the troughs will resist the action of the soured milk. A very good trough can be made from sawn timber, provided it is well joined and tarred thoroughly before use, so that the food will not soak into the wood, and if it is built at a slight slope and has a bung at the lower end it is easily kept clean. Other points of importance regarding troughs are that they should be of sufficient weight to prevent their being overturned, and they should be so constructed as to prevent as far as possible the pigs from standing in them. Infection from most parasitic diseases occurs through the mouth, and if a pig is running about and trampling in the dung and urine of other pigs, and then stands or lies in the trough, he may convey the eggs of intestinal worms to the food, and thus set up further infestation.

Food and Feeding Methods.

Another important point in the maintenance of the health of pigs and the maintenance of the greatest possible returns is to be found in attention to correct feeding. Certain ailments of pigs are entirely due to errors in diet, and even if no specific disease occurs unthriftiness and tardiness in maturing are often due to the foods given and the methods of feeding. For instance, the lack of certain elements in the food often leads to such diseases as rickets, while contaminated soured food may set up digestive disturbances. In addition, poisoning may occur very simply, as in the case of brine in butter-milk, which has been known in several cases to have caused severe losses.

The pig puts on more weight in return for a given quantity of food than any other animal—that is, it turns a bigger proportion of what it consumes into profit. Again, the pig will dispose of classes of food which otherwise would be of no economic value on the farm. On this account the pig is looked upon as a scavenger, and many articles of food are fed to it in a putrefying or mouldy condition. Not only are foods in such a state a fruitful source of disease, but the flesh of the animals so fed will be of poor quality. The quality of the bacon depends upon the food given, and first-class flesh cannot be expected from pigs not suitably fed.

Foods are classed according to their composition, and the substances which are utilised in the animal body may be roughly classified as—(1) starchy and fatty materials, which produce heat and fat in the body, and are known as carbohydrates; (2) substances containing a large amount of nitrogen, commonly called proteins, and essential to the muscular growth and development of the body; and (3) mineral salts, which are necessary to body changes and the building up in the growing animal of the harder tissues of the body, such as bone. All foods contain a combination of these materials to a greater or less extent, but some are richer in one or more classes than others. Thus, most root crops, such as potatoes, sweet potatoes, turnips, arrowroot, artichokes, grains such as maize, wheat, &c., and vegetables and fruits are very rich in starch and sugar, while linseed meals, oil cakes, &c., and unseparated milk contain a large percentage of oil. Peas, beans, lucerne, clovers, milk, meat-meal, flesh, and other animal products have a big percentage of protein. Mineral matters are present to a great extent in milk, oats, mill offal, lucerne, peas, and beans.

In addition to these substances in foods there are present certain compounds the exact chemical composition of which is not fully understood, but which are vitally necessary to the health of stock. It is possible for a chemist to manufacture a food apparently perfect in its combination of all necessary elements, yet animals would not thrive on it. What are lacking are the substances referred to, technically known as vitamines.

Fortunately, these are present in most foods used for pigs, and they are exceptionally abundant in milk, green foods, and grains.

From what has been said above it will be noted that milk in its unseparated state is a perfect food, in that carbohydrate, protein, and mineral substances all enter into its composition, and even when the fat is removed the skim-milk still supplies many of the needs of young growing stock. Milk, therefore, if used in combination with other foods, is useful for all classes of pigs.

In feeding pigs, as in the case of any other stock, the animal must keep steadily growing. The object of the pig-raiser is to ensure the normal physiological development. If for any reason at all, such as disease or unsuitable food, the animal receives a set-back, this normal growth is interfered with, and the pig will not mature as quickly as desired, and may not grow into a first-class animal. Feeding should commence before the young are born, attention being paid to the condition and health of the sow. Sows in pig should not be too fat, since over-fat pigs often have trouble at farrowing. The food at this time should contain a fair supply of protein and mineral matters, so these are required for the developing young. If they are not present in sufficient quantity in the food the sow has to draw them from her own body, and the result is usually an unthrifty or ricketty litter. Milk, lucerne, mill offal, a little oilcake and meat-meal are all useful foods at this time, but maize, on account of its fattening properties, should not be given in any quantity. Green food is particularly valuable, as not only is it rich in the required body-building materials, but it corrects any liability to constipation. The same class of foods may be continued when the young are born. Mill offal, milk, and lucerne are especially beneficial, and may be taken with benefit by the young stock. Grazing is the best method of feeding the green food, since the pig has exercise while feeding. If lucerne is not available for this purpose, rape, peas, grasses, and root crops, such as sweet potatoes and artichokes, will give good results. To keep the pigs in good growing condition a variety of foods may be used, as long as care is taken that the ration contains the protein substances necessary to the growing pig. On dairy farms, where milk is always available, this, in conjunction with other foods, keeps the stock in good condition. Where grazing is not practised, root crops, vegetables, and fruit unfit for market are valuable to replace it. For the final period of fattening, milk and maize give the best results; but where maize is not available other grains, if reasonable in price, will produce good results. Other grains will give equally good results, and in wheat districts, wheat boiled or steamed before use can be fed to pigs very profitably.

There are occasions when it is not economical to give pigs exactly the food required, and the diet is liable to be in some way deficient. This especially occurs with regard to such mineral substances as lime and phosphorus. Such a deficiency can be repaired by the addition of sterilised bone-meal. A supply of wood-ash and charcoal, to which a little sulphur and salt have been added, is also appreciated by the young pigs, and supplies any shortage in the mineral constituents of their food.

In dealing with the foods mentioned it is assumed that they are fit for food. Reference has already been made to the possibility of disease arising from semi-putrid milk. Where swill and hotel refuse is collected for food it should be fed before it becomes soured, since there is great danger of poisoning from soured swill. In addition, it should always be boiled before use. Fruit, vegetables, and root crops when rotting are also a common source of digestive derangements, while maize fed in a mouldy condition may cause poisoning and nervous disorders. The danger of sickness may be lessened in all these cases by boiling the food before giving it to the pigs.

(*To be continued.*)

TO PREPARE SOD LAND BY "SKINNING AND TRENCHING."

MR. JAMES MCKENZIE, "Orchardville," Wingello, describes a method of preparing sod land for vegetable growing by a process of skim ploughing, a method sometimes called "skinning and trenching." Provided the right type of plough is used, says Mr. McKenzie, the procedure is very simple. The coulter and share type of plough, with a wheel attachment for regulating the depth, is the most suitable for the process, which really consists of making two furrow cuts where one is ordinarily given—the first to a depth just sufficient to skim or "skin" off the sod, and the second (which constitutes the trenching) to about the ordinary depth. The first furrow is opened in the usual way. The wheel is then let down so that the cut is only about an inch deep, and the skimmed sod is turned into the bottom of the furrow previously opened. The wheel is next lifted, and the skimmed strip ploughed to normal depth, when the resulting furrow will cover the sod just removed.

When ground has been ploughed in this manner, no difficulty will be experienced subsequently in reducing it to a fine tilth, and although double the usual time is taken over the ploughing, much is saved in the finish. Mr. McKenzie adds, that after allowing land that had been ploughed as described, to lie for a couple of months and ploughing it again, scarcely a sign of turf was to be seen, and that the process should be of great help to the man struggling with new ground. He stresses two points. The first is that the coulter must be used to cut the "skin," or the desired result will not be achieved, and the second is that the best results are obtained when a half-worn share is used, as a too-broad share makes the plough awkward to hold, and in any case is not necessary.

TO THIN A LOQUAT TREE.

THE general practice, when thinning loquats, is to remove the tops of the bunches on some trees and to take the fruit off the lower part of the bunches on other trees. By thinning in this manner the crop on a comparatively large area is more easily managed, as the ripening is spread over a longer period, the fruit on the lower part of the bunches generally ripening before that on the tops. The work is generally done as soon as the setting of the fruit is decided, and if the crop is heavy a good many shoots are thinned out, which also removes some of the bunches.—W. LE GAY BRERETON, Assistant Fruit Expert.

THE VALUE OF VIRUS IN RODENT DESTRUCTION.

THE suggestion is quite often made that rodents might be destroyed in large numbers by spreading diseases among them, but experiments conducted in various countries have long indicated that the issue is not anything like so simple as it seems. In a bulletin entitled "The Destruction of Rodents" the South African Department of Agriculture sums up the evidence for and against the use of virus as follows:—

1. The claim of harmlessness to a man and domesticated animals is at least open to doubt.
2. Virus quickly deteriorates with age, and is then useless.
3. Experiment with a caged rat has shown death to result from virus with such rapidity as to suggest that the rat died as the result of eating toxic substances produced by the bacterial growth in the cultures, rather than as a result of contracting disease.
4. If an animal receives too small a dose it becomes immune to the effect of virus.
5. Although a proper dose of fresh virus may produce a fatal disease, many trials have shown that the disease cannot be depended upon to spread from one animal to another under natural conditions.
6. To give each animal a dose means that the virus is being used in the same way as an ordinary poison, with the disadvantage that it is far more expensive than the poison when used in the same manner.

It is also pointed out in the South African publication that in the great outbreak of field mice in Nevada, in 1907, the attempt to stem the tide by the production of epidemic diseases through the use of the various commercial bacterial preparations was attended by complete failure, and that the United States Department of Agriculture does not prepare, use, or recommend the use of virus. Neither do English departmental recommendations support the use of virus. The following passage is quoted from a bulletin issued recently by the British Museum ("Rats and Mice as Enemies of Mankind," M. A. C. Hinton):—"The harmlessness claimed for all [kinds of virus] towards animals other than rats and mice is, at least in many cases open to question. . . Not one of the many preparations sold can be recommended as a safe and thoroughly reliable means of destruction."

AN OIL AND ARSENIC SWAB FOR SHEEP.

OIL and arsenic can be combined to make a very good swab for dressing sheep. The formula recommended by the Department is as follows:—Water, 25 gallons; oil, 25 gallons; soap, 10 lb.; arsenite of soda, 1¾ lb. In place of the arsenite of soda, 1 lb. of white arsenic and 3 oz. of caustic soda may be used, if desired. To emulsify the ingredients so that they will mix, boil the water and add the soap, dissolve the arsenite of soda in a gallon of water, and add it to the boiling soap and water, and finally pour the oil into the resulting mixture, tipping the whole repeatedly from one vessel to another until thoroughly incorporated. When the mixture cools it will settle into a thick sticky mass. This can be stirred up and used as a swab in its cold state, or it may be warmed by the addition of a little hot water. A number of sheepowners use this swab with success.—W. W. FROGGATT, Government Entomologist.

Cheesemaking on the Farm.

[Continued from page 46.]

J. G. McMILLAN, M.B.D.F.A., N.D.D.

Modifying Methods to Correct Milk Troubles.

Over-acid Milk.—Even in the best regulated dairies acid or gassy milk will sometimes occur. In such cases modifications have to be made in the process of manufacture. In the case of over-acid milk such modifications are as follows:—Raise the temperature of the milk to a higher temperature, 90 deg. Fah.; add more rennet, well diluted, and stir throughout for half a minute; cut the curd finer, four or five times; heat more quickly to a higher temperature, say, 104 to 106 deg. Fah.; draw the whey while cooking is proceeding; draw all the whey when acid is showing about ⅛ inch on the iron; stir well on the racks and pack shallow; pile very little, if any; mill earlier; salt earlier.

The foregoing method is satisfactory with milk showing up to ·26 to ·28 per cent. of acid, but even with that amount it is advisable to neutralise with caustic soda and pasteurise (see Farmers' Bulletin, No. 136). This neutralisation has proved very satisfactory, and in the event of the night's milk being found over-acid this treatment with soda will save the trouble of making up the two milkings separately. The cheesemaker must always bear in mind that even with expert treatment of over-acid milk the yield will suffer.

Gassy Milk.—This is even worse than over-acid milk and unless pasteurisation is adopted it is impossible to produce a good cheese. With an acid milk one can tell at the very beginning what the trouble is, but with a gassy lot very often there is no indication of trouble until the cooking is completed, when the curd will probably float. Sometimes it will show at cutting, when particles of the curd will float on the surface. When once gassy milk occurs, it will generally do so for several days in succession. In such a case endeavour to find out the source of contamination and even change the cows into other paddocks. See particularly that the cows' drinking water is good, that milking is done in a cleanly manner, and that all utensils are clean. The starter may be the trouble; if so, make a fresh one and allow the milk to ripen naturally until the new starter is ready. Should gassy milk be suspected adopt the following method:—Add more starter (if good); allow more acid to develop before renneting the milk; heat in cooking process slower and to lower temperature, say to 96 to 97 deg., or from 2 to 3 deg. lower than the ordinary temperature of cooking; allow more acid (about ·22 to ·23 per cent.) to develop in the curd before drawing the whey; stir very little on the racks and pile deep; allow a longer time between milling and salting, stirring frequently to aerate and thus assist in getting rid of gas; develop more acid at salting, and when the curd is badly tainted add slightly more salt.

Use of Pasteurised Milk for Cheese.

Until a few years ago it was considered that good cheese could not be made from pasteurised milk. About fifteen or sixteen years ago, when in the Victorian Department of Agriculture, the writer conducted experiments with most satisfactory results, and later, while he was Dairy Instructor at Hawkesbury Agricultural College, it was decided to export a quantity of cheese to London with a view to advertising Australian cheese. Two tons were sent, the milk from which the product was made being pasteurised. The English comments were most favourable, the cheese being considered to be the best ever received from Australia, and equal to the best New Zealand and Canadian product. American experts conducted a series of experiments in cheesemaking from pasteurised milk, extending over some months, and not only was there a marked improvement in quality, but the average increased yield was over 5 per cent., owing to less solid matter being lost and to more moisture being retained without detracting from the body of the cheese. In the American experiments it was found that the heating process affected the coagulation properties, and to restore them a certain quantity of hydrochloric acid was used. New Zealand has now generally adopted pasteurisation of milk for cheese, but the makers there do not use any acid. The result is that in our sister colony the quality of the cheese has been greatly improved. Cheese made from milk that has been pasteurised withstands excessive heat after manufacture much better than that made from unpasteurised milk. It is to be hoped that New South Wales factories, the patrons of which are many, will adopt pasteurisation at an early date.

A few experiments to further demonstrate the efficiency of pasteurisation were carried out at Hawkesbury College recently, under the supervision of the writer. These have demonstrated, not only an improvement in quality, but also an increased yield. A certain quantity of milk was taken, thoroughly mixed, and divided into exactly equal parts. One half was heated to 160 deg. Fah. and cooled as quickly as possible to about 86 deg. Fah. Good starter was added to each vat, and after a certain amount of acidity was developed the rennet was added, the subsequent process being as with an ordinary good milk. The average increased yield from the pasteurised lots was 2·75 per cent., and in every instance the quality was better. Even with the evening milk, when it was cooled and kept in a cool room, there was improvement. The accompanying plates will show the reader the effect of heating on the biological content of the milk.

A further series of experiments was carried out for the purpose of testing the efficacy of pasteurised milk to which hydrochloric acid had been added as compared with that to which no acid had been added except starter. The milk was equally divided after pasteurisation and cooling, and starter then added. In every instance there was a bigger yield of cheese when the acid was added prior to renneting, the extra yield being 3 per cent. This, together with the extra yield due to pasteurising, make a total extra yield of 5·75 per cent. It might be thought that the use of hydrochloric acid would be detrimental to health, but it has been proved that it is of assistance to the digestive organs; anyone who cares to try the process for themselves may do so. It is very necessary for great care to be taken in adding the acid, otherwise, owing to its strong nature, it is liable to coagulate that part of the milk with which it comes immediately in contact. Normal acid is used, sufficient being added to the pasteurised milk to raise the acidity to ·25 per cent. One pound of normal acid will raise the acidity in 100 lb. milk ·09 per cent., so that supposing the milk after pasteurisation showed ·2 per cent. of acid present, then it would require ½ lb. of acid to raise it to ·25 per cent. Lactic acid will act equally as well in the restoration of coagulation properties, so suppose ·24 per cent. of that acid had developed in the milk this could be safely pasteurised when it would not be necessary to add hydrochloric. Should the cost of hydrochloric acid be considered prohibitive, it has to be borne in mind that with its use only half the amount of rennet is required, so that the cost of one is equalised by the saving in the other. For the sake of the cheesemaker who desires to test pasteurisation, the method of procedure in a small factory where there is no proper pasteuriser, is detailed hereunder.

Pasteurisation in a Small Factory.

Having first seen that there is water in the jacket of the making vat, put in the milk, and turn on the steam, heating the milk as quickly as possible to about 156 deg. Fah., and keeping it well stirred meanwhile. Have the pipe cooler handy so that the milk, after cooling, will gravitate into the vat. Draw all the milk off into the cans or tank that feed the cooler, rinse out the vat with hot water, turn the water on to the cooler to start the milk running over, meantime putting about 1 per cent. starter in the vat. By the time all the milk is cooled to 86 deg. Fah., sufficient acid will have developed in it for renneting. The subsequent process is then the same as for raw milk. If it is desired to add hydrochloric acid, the exact quantity required should be mixed with several times its volume of water in a jar, preferably one with a glass tap. This jar is placed in such a position that the dilute acid will fall on to the stream of milk as it leaves the cooler. When the milk stops flowing the acid must be turned off also, and while this is going on the milk in the vat must be frequently stirred. Once the cooling is done a test of the milk is made for acidity, and if it shows ·25 per cent. of acid it may be considered satisfactory. If the right amount of acid is present, the whole process may now be done by time schedule as follows:—

8 a.m. ...	Add rennet at the rate of 2 oz. per 100 gallons of milk.
8·25 a.m. ...	Cut curd, then stir with hands.
8·40 a.m. ...	Turn on steam.
9 a.m. ...	Turn off steam, temperature being now 104 deg. Fah.
10·30 a.m. ...	Whey should be all off, and curd on racks.
12 noon ...	Mill the curd and stir frequently.
1 p.m. ...	Apply salt.
1·20 p.m. ...	Hoop curd.

The exact time from renneting to hooping is thus 5 hours 20 minutes, and there must be no variation from day to day. With this method no tests are made, excepting for renneting. The writer is quite satisfied about the efficiency of the process, but would advise anyone contemplating the use of thit method to see it done once or twice before adopting it.

This method of pasteurising is rather crude, but our object is to show that the process can be done on a small scale without any extra expense excepting that of water supply. So as to save time, however, it is recommended that an extra vat be obtained. This vat may have long legs, or be placed on a platform, so that the milk will flow from it over the cooler and then into the making vat. The milk may be placed directly into the elevated vat, the night's milk being partially heated to, say, 140 to 160 deg. Fah. before the morning's milk is added. Whilst the latter is being put in, the steam is turned on full, and the requisite temperature is reached in a few minutes. At once the cooling is started, and thus little delay is incurred. As already stated, even pasteurisation without the addition of an acid, when there is tainted milk, will be of material advantage. If the farm cheesemaker is able to control his milk supply properly he should, as a general rule, have little trouble with flavour, but the extra gain in weight alone makes pasteurising worthy of consideration, even in the best regulated dairy. Suppose that 70 cows are milked on the farm and that these give an average yield of 475 gallons, a total of 33,250 gallons. An extra yield of 5 lb. of curd per 100 gallons of milk would give a total extra yield of 1,662 lb. of cheese, which at 1s. per pound would mean an extra £83 2s. Put down the extra cost of pasteurising (that is, for fuel) at £13, and there is a balance in favour of pasteurising of £70.

Whey: its Value and Treatment.

One will often hear it said that whey is of no value as a food, but we have only to look at the appended analysis to see that this is erroneous. Whey contains on an average the following ingredients:—

	Per cent.
Water	93
Fat	·4
Casein and albumin	·9
Sugar	4·5
Mineral matter	1·2
Total	100·

From 33,250 gallons of milk we would get at least 29,650 gallons of whey, or about 132½ tons. In this amount there would be almost 20,000 lb. of valuable food products—fat, casein, albumen and sugar, not to mention the ash or bone-forming material. This gives an albuminoid ratio of 1 : 6 on the above analysis. Whey is generally put down as being of half the value of skim-milk. At the present time separated milk is valued at 2d.

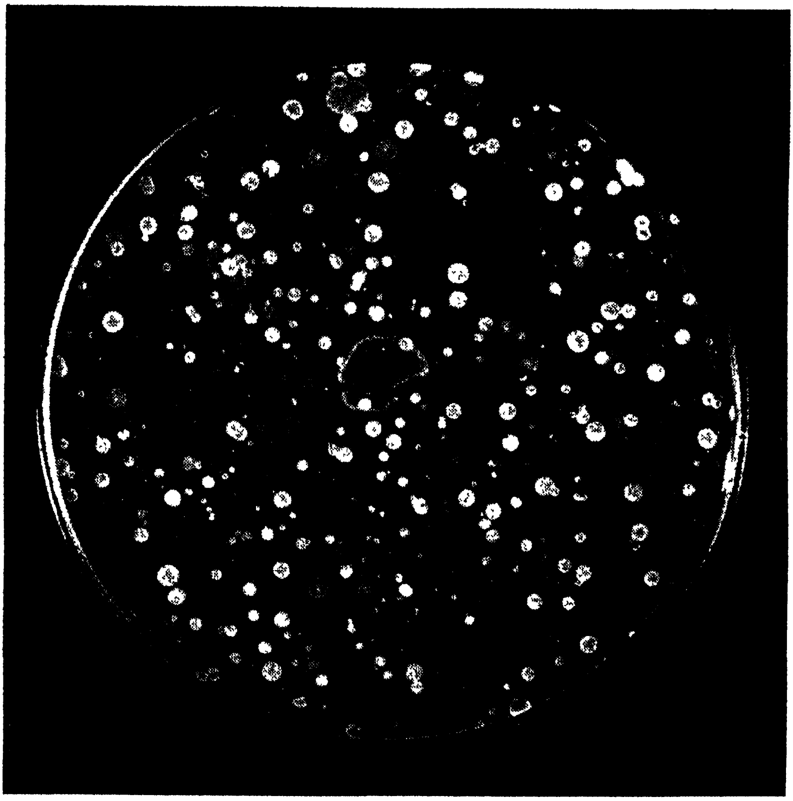

Fig. 30.—Plate culture of mixed milk in the receiving vat *before pasteurisation*

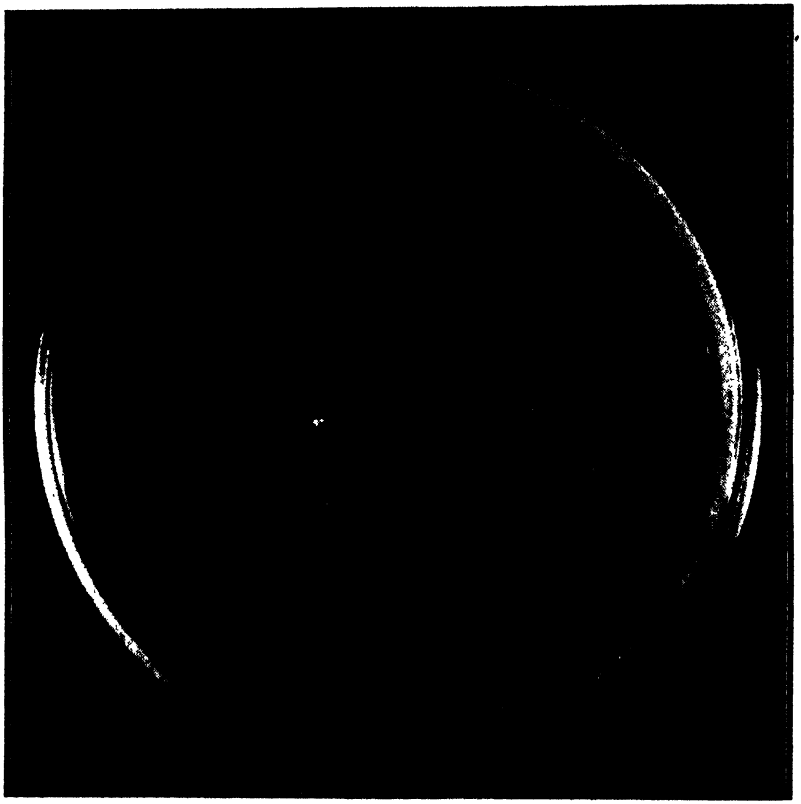

Fig. 31.—Plate culture of milk *after pasteurisation.*

Pasteurisation reduced the bacterial count from 111,080,000 to only 2,000 per c.c.

per gallon, therefore the total value of the whey, in this illustration, would be £123 10s. 10d. The amount of separated milk would be about the same as that of the whey, therefore its value would be £247 1s. 8d. In estimating the comparative merits of cheesemaking on the farm and of separating and sending the cream to the factory, the relative values of the by-products must be considered. There is no doubt, however, that whey has a high feeding value, and when fed to calves or pigs with the addition of a small

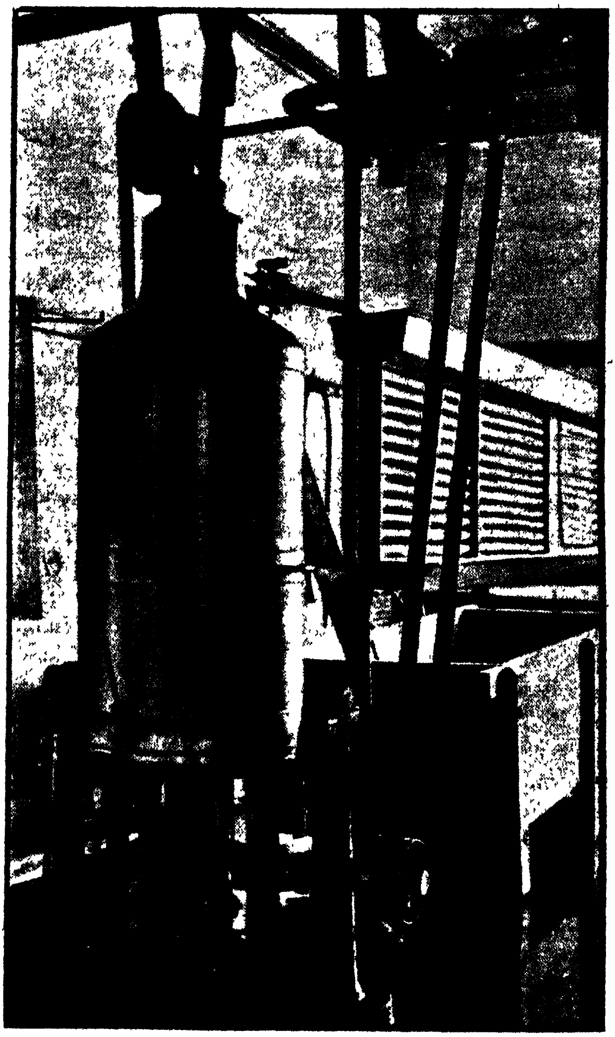

Fig. 32.—Milk pasteuriser, with pipe cooler, in use at a cheese factory
This machine effectively pasteurises 1,200 gallons of milk per hour.

quantity of concentrated food, such as linseed or decorticated cotton seed meal, in the form of porridge, satisfactory results can be obtained. The writer knows of some dairymen who prefer whey to separated milk, particularly in the feeding of calves, the whey not being so liable to cause digestive troubles. To get the best value out of whey it is necessary to keep it sweet, otherwise a portion of the milk sugar is converted into lactic acid, and its food value thereby reduced. As soon as the whey is drawn it should be heated to about 157 deg. Fah. and the utensils used in connection with its use must be kept scrupulously clean.

OTHER VARIETIES OF CHEESE.

Seeing that the public taste at present is for cheese in a fairly fresh state, where milk can be kept in good condition, particularly during the cooler months of the year, it is economically advantageous to make cheese that at a month old will have a cheese-like taste. This is done by heating the curd to a lower temperature and thus incorporating more moisture. This class of cheese has some disadvantages compared with cheddar, insofar that when once it matures it goes off rapidly in flavour. Neither does it withstand the hardships of transport as well as a firm cheddar—when it has to be sent any distance by rail or boat it must be well packed in crates. Where a softer cheese can be made and delivered direct to the retailer or consumer, however, the extra profits are very considerable,; the writer has known of cases where from 120 to 125 pounds of cheese were obtained from 100 gallons of milk.

The manufacture of the softer varieties of pressed cheese requires the same care with the milk as in the manufacture of cheddar. In almost every instance the method of manufacture is a modification of that of cheddar, and in giving a description of some of these cheeses, therefore, it will not be necessary to give a detailed account of the manufacture so long as the cheesemaker has studied carefully the principles of cheddar cheesemaking as already laid down. A great many of the English counties have their special make of cheese, the consumption being principally confined to the county in which the particular cheese has its origin. For example, the Lancashire cheese is confined to that county, and the average workman will only eat that kind, whereas in Somerset, the home of the cheddar, a Lancashire cheese would not be seen on the grocer's counter. Probably in time to come the same fads may be found in Australia.

Derby Cheese.

This is a variety of cheese the manufacture of which has been successful with some makers during the last few years. It should be made in a flat shape and should weigh about 20 lb. It can be made from mixed milk, provided the evening's milk is perfectly sweet. About ¼ to ½ per cent. of starter is added in the usual way. The temperature of the milk is raised to 85 deg. Fah., and colour is added in the usual quantities. When the milk shows a rennet test of 22 seconds or ·18 deg. acid, rennet is added in the same proportions as for cheddar. The time of coagulation should be about 40 minutes. The curd is cut lengthways and crossways, once with the horizontal and twice with the vertical knife. The whey at this stage should not show more than ·12 per cent. acid. The curd is now gently stirred with the hands for about 10 minutes, and the heat afterwards applied, the temperature being raised steadily so that the desired temperature of 95 to 96 deg. Fah. is reached in 40 minutes. After the cooking temperature has been reached, stir for about 10 minutes, and when the curd shows about ·15 per cent. acid in loose whey or ⅛ in. threads on the hot iron, the whey should be drawn off without delay.

The curd is then placed on the racks about 4 inches deep, and must be stirred very little owing to its softness. At this stage it should have a velvet-like feeling, and the mass should shake like a jelly; the whey at this stage should not show more than ·19 per cent. acid. At the end of 15 minutes the curd should be cut into blocks and piled two deep, and in another 15 minutes should be turned again and doubled, and both once again 15 minutes later. At the end of an hour from drawing the whey the curd should be ready for milling and should draw a little over ⅛-inch threads on the hot iron. Mill in the ordinary way and stir slightly, and at the end of ten minutes salt at the rate of 1 oz. to every 2½ gallons of milk. At time of salting the whey should not have more than ·45 to ·5 per cent. acid.

This cheese is put into the hoops in the same way as cheddar. Pressure must be applied very gently at first—if done too rapidly the curd will be squeezed out of the vats, and there will also be loss of fat. The total pressure at any time should not exceed 15 cwt. The next morning the cheese is taken out of the hoops and placed in the curing room, the temperature of which should never rise above 70 deg. Fah.

Derby cheese will be fully matured at the end of six weeks, but at two weeks it will have as much flavour as a cheddar a month old. In the case of Derby cheese 1 lb. can be produced from 8 to 8½ lb. milk.

Caerphilly Cheese.

Caerphilly cheese is manufactured to a great extent in the south-west of England, and is very popular amongst the miners. It is a cheese that can be manufactured from small quantities of milk. The night's milk should be perfectly sweet and when mixed with the morning's should show not more than ·18 per cent. acidity. About a pint of starter may be added just prior to renneting; no colour is used; rennet is added at the rate of 1 drachm to 3 gallons milk when the temperature is 86 deg. Fah. In forty-five minutes the curd is fit to cut, the cutting being done in the same way as for Derby (three cuts). At the cutting stage the curd should show not more than ·12 per cent. of acid. After cutting do not disturb the curd for ten minutes, then stir gently for about twenty minutes, raising the temperature meanwhile to 88 deg. Fah. When the whey shows slightly over ·15 per cent.

acidity it should be drawn, the curd being then placed in coarse cloths which are tied up tightly in the fashion of a plum pudding. After half an hour, cut into 3 inch blocks, putting the outside of the curd inside, tie up again and turn the bundle over. This procedure is repeated once or twice. At the end of about an hour or an hour and a quarter, sufficient acid will have developed in the curd for salting. It should draw rather less than ½ inch on iron. Break the curd up into small particles with the fingers, and apply salt at the rate of 1 oz. to 3 lb. of curd and stir well in. The whey draining from the curd at this stage should not show more than ·4 per cent. acidity. The curd is placed in hoops lined with cloth and pressure gently applied.

Fig. 33.—Curd breaker, suitable for use in handling small quantities in place of the American knives.

This is a cheese that can easily be made where as low a number as six cows are kept. The appliances required are few for a small quantity of milk. The heating of the curd can be done by dipping some of the whey, out of the receptacle which contains the milk, into a bucket which is set in some boiling water. The temperature of the whey is thus brought up to about 130 deg. Fah., and by pouring it on to the curd the temperature of the latter should be raised.

It is better to heat two lots of whey than one, as the heating is then more regular. A carving knife may be used in place of the usual vertical knife to cut the curd lengthways and crossways, and by using an arrangement with wires the horizontal cut can be made or the old-fashioned breaker, as illustrated, used. A lever arrangement can be fixed on a wall to give the necessary pressure.

The cheeses generally range from 8 to 20 lb. in weight and should be flat; if they are too high and narrow they will get out of shape. Cheeses should be kept in a room that does not get over 70 deg. Fah., and should be wiped occasionally with a cloth dipped in brine.

Caerphilly cheese will be ripe in two to three weeks, and is very palatable if made from clean milk.

(To be continued.)

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THE agricultural outlook of 1922 is favourable. We should see marked improvement over conditions as they have existed this year. Time will be required for full recovery, but we have reached the bottom, and are on the up-grade. The most important things farmers should work for are the perfection of their co-operative selling organisations, with a view to putting the marketing of farm products on a thoroughly sound business basis, and the careful study of needs of the consumer, and intelligent adjustment of production to these needs.—HENRY C. WALLACE, Secretary of U.S.A. Department of Agriculture.

Orchard Experiments.

SPRAYING TRIALS AT GLEN INNES EXPERIMENT FARM.

W. J. ALLEN.

ORCHARD experiments of different kinds (including trials of preventive and curative treatments of various diseases of fruit) have been carried out by the Department for many years, but although departmental recommendations on the related aspects of fruit-growing have been amended in accordance with the conclusions arrived at from time to time, and these recommendations are available in a very complete series of publications, it has not hitherto usually been the Department's practice to publish accounts of the experiments in detail. It is intended, however. to report such experiments in the pages of the *Gazette* in future, together with any conclusions arrived at, and in some cases the progress of the trials season by season.

The first experiments to be dealt with in this manner are the spraying experiments carried out during the season 1920–21 at Glen Innes Experiment Farm, where Mr. W. W. Cooke is in charge as orchardist.

The trials fall under five distinct headings, thus:

1. Experiments in the control of powdery mildew of the apple (plots 1, 2, 3, 4, 6. 7, 8, 11a, and 11b).
2. Experiments in the control of black spot of the apple, the treatments' effect on apple mildew incidentally to be observed (plots 9, 12a, 12b, and 13b).
3. Experiments with combined sprays in the control of both black spot and powdery mildew of the apple (plots 10 and 13a).
4. Experiments to determine the damaging effect, if any, of various sprays applied at different strengths and periods (plots 14b. 15, 16, 17. 18, E, F, G, I, J, K, L, Ma, Mb, and N).
5. Experiments to determine the effects of lime-sulphur applied at various strengths in spring and summer on (*a*) cherries (plots Ac Bc, Cc, Ec. and Fc), and (*b*) pears (plots Cc, Ec, and Fc).

Unless otherwise stated, the lime-sulphur spray used in the experiments was made according to the formula given in the departmental publications "Spraying" (Farmers' Bulletin, No. 72) and Spray Leaflet No. 3 "Lime-sulphur." The various strengths referred to were in accordance with the standards set down in the table of dilutions which figures in those publications.

The Powdery Mildew Experiments.

In these experiments, as the accompanying table shows, a number of different treatments were subjected to trial. The tests of atomic sulphur supplemented some already made, and the results again showed that 10 lb.

atomic sulphur to 83 gallons water is sufficient to give satisfactory control. An application made at pinking stage, in addition to that at the spur-bursting stage, and in each case followed by an application combined with the three regulation lead arsenate sprays, showed no better control than a spraying carried out at the spur-bursting stage followed by applications combined with the lead arsenate sprays.

Spraying with 6 lb. of atomic sulphur to 83 gallons of water did not give as effective control as 10 lb. to 83 gallons, and although 14 lb. to 83 gallons gave slightly better control than 10 lb. to 83 gallons, it is questionable whether the extra amount of sulphur was warranted by the results. The higher quantity was used primarily because the makers of atomic sulphur claim that it will control black spot of apple, but as there was no outbreak of black spot in the orchard no comment is possible on this point.

Sulphuric acid (1 to 1,500 parts water by volume) again controlled powdery mildew of the apple fairly well. Although this strength does not damage the foliage or fruit, it cannot be used, of course, in conjunction with lead arsenate, and if applied a few days after the trees have been sprayed with lead arsenate both foliage and fruit are damaged. It is, therefore, an unsuitable spray for apple trees, and further experiments in this respect will not be continued.

Owing to supplies of atomised sulphur being delayed, the first two applications of this material had to be omitted, and the results cannot therefore be compared with those obtained from the other mildew sprays tried. Even as applied, however, it gave a partial control of mildew. Tried in combination with lead arsenate, it did not prove harmful to either fruit or foliage.

Colloidal sulphur and colloidal sulphur paste, prepared by precipitating the sulphur in lime-sulphur solution, have now for two seasons given results equal to those obtained by atomic sulphur in the control of mildew, and their application has not been attended by any harmful effects. Tests with these materials are being continued, however, and recommendation of its use will depend upon further results. The paste also gave satisfactory results when combined with lead arsenate.

In the light of these and previous experiments and of departmental orchard experience generally, the Department at present recommends the following treatment for control of powdery mildew of the apple :—

Cut out and burn all mildewed twigs during winter pruning, and remove, as far as possible, all mildewed terminal buds.

Spray with atomic sulphur (10 lb. to 80 gallons water) from spur-bursting to pinking stages.

Spray with atomic sulphur combined with lead arsenate at the periods prescribed for the application of the latter for control of codlin moth

The Black Spot Experiments.

Although there has never been any outbreak of black spot of apple and pear at the Glen Innes orchard, some of the experiments originally designed to test the efficiency of lime-sulphur in the control of this disease have been retained. The experiments with Bordeaux mixture, originally designed to test this fungicide in the control of black spot of apple and pear, have been dispensed with, that fungicide being liable to cause severe russeting of the fruit in the Glen Innes district.

A proprietary substitute for lime-sulphur at the rate of 3 lb. to 50 gallons water was tried (plot 14a) on several varieties of apples, first at pinking stage, and later combined with each lead arsenate application. This spray caused no damage, but, as already explained, there was no opportunity of judging its efficiency as a fungicide for black spot. It gave a slight control over mildew, but was not equal to atomic or colloidal sulphur.

Lime-sulphur showed a slight control over powdery mildew of the apple, but proved inferior to atomic sulphur or colloidal sulphur. It might, nevertheless, be noted in relation to the control of the disease in question, as this occasion is the only one since its trial as a spring and summer spray at the Glen Innes orchard in 1913 that it has given any definite control.

The Search for a Combined Spray.

In order to obtain a spray that would give immunity simultaneously against both powdery mildew and black spot of the apple, atomic sulphur was applied, first with lime-sulphur at spur-bursting strength (10 lb. sulphur to 83 gallons total combined spray), and later with lime-sulphur at summer strength for apples and pears, these second sprayings being made in conjunction with applications of lead arsenate, thus making a triple combination.

In the absence of any black spot, the results of this experiment also were indeterminate. The combined spray controlled mildew and caused no harmful effect—as distinct from atomic sulphur combined with Bordeaux mixture, which in trials over two seasons has caused severe damage to fruit and leaves.

Danger Periods and Strengths.

As Bordeaux mixture is one of our most efficient fungicides, but, unfortunately, liable to cause more or less severe russeting to apples and pears, an experiment was designed to ascertain at what stages of growth of the fruit this spray caused the greatest injury. The following conclusions have been arrived at:—

1. That Bordeaux mixture can be applied without russet injury at early spur-bursting stage—that is, when a very large percentage of the spurs have opened only sufficiently to expose the tops of the enclosed blossom buds.
2. That if Bordeaux mixture is applied when the blossom buds begin to separate from one another, and are, therefore, more exposed than at early spur-bursting stage, severe russeting may result, even if the trees receive no later application.

In experiments carried out in 1919–20, applications of Bordeaux mixture made four to five weeks after the petals fell caused less russeting than when applied at the pinking or calyx stages, and still less at nine weeks after the fall of the petals. This difference was not so clearly demonstrated in the 1920–21 experiments.

It is interesting to note that Bordeaux mixture gave slight control over powdery mildew this season at Glen Innes. Except in a small experiment carried out eight years ago, when it gave a very decided control on Rome Beauty trees, Bordeaux mixture has always failed to control this disease. Even in the season in which the exceptional result mentioned was noted, in a far larger experiment on Cleopatra trees it failed to give control, as in the season previous in a large experiment on Rome Beauty trees.

Several varieties of apples were sprayed at the spur-bursting stage with Bordeaux, and sprayed the following day with miscible oil (1 to 25 parts water). No advantage was apparent from the use of the covering spray of oil, although no ill effect was noticed. Experiments in previous years have shown that it is risky to use a cover spray of oil at pinking stage.

Extensive experiments were carried out at the Glen Innes orchard from 1913 to 1916 to determine at what strengths lime-sulphur could be applied on apples and pears at various stages after the trees had started into activity in the spring. After these determinations had been made, the Department received reports from two localities of the use of lime-sulphur causing a drop of apples, and in 1918 experiments were again designed to test these strengths, both in combination with lead arsenate and without it. These tests were continued until the 1920–21 season, and the table of dilutions is still adhered to in the departmental publications dealing with lime-sulphur.

These later experiments showed that when lime-sulphur was applied at spur-bursting stage, pinking stage, and three times after setting with each lead arsenate application, it retarded the growth of the tree and fruit; this was more marked in the case of Williams pears, and it also sometimes caused slight russeting of Beurre de Capiaumont pears. It should be mentioned that Bordeaux mixture applied in a similar manner has the same retarding effect, and also causes more or less russeting of all varieties. For this reason, and also for economy, it is wise only to continue the later applications of fungicide if the weather conditions and prevalence of black spot indicate their necessity.

Experiments have been carried out during the past four years to ascertain at what strengths lime-sulphur can be applied to cherry trees during early spring and summer. The tests included Early Lyons, Florence, St. Margaret, and Black Republican varieties, and the results showed that the strengths recommended in the table of dilutions for lime-sulphur for the respective stages of apples can be applied to the above-mentioned varieties of cherries.

Previous experiments have shown that it is risky to apply lime-sulphur to peach, nectarine, apricot, and Japanese plum trees later than the pinking stage.

Tobacco Spray Trials.

A comparative trial was made of three tobacco washes—one prepared according to the departmental formula, and two from well-known brands of concentrated nicotine. No difference could be detected in the results of the three.

SPRAYING Experiments at Glen Innes Experiment Farm Orchard, 1920–21.

Plot.	Variety of Fruit	Treatment.	Results and Remarks.
1	Apples.—Stone Pippin, Granny Smith, London Pippin, Cleopatra, Rome Beauty, Buncombe, and Jonathan.	Sprayed with atomised sulphur (6 lb. to 100 gallons) combined with each lead arsenate spray.	No damage resulted from this spray, and the mildew was practically controlled, but the results were not as good as those obtained from the use of atomic and colloidal sulphurs Owing, however, to the late arrival of the mixture, the first two applications as shown on Plot 3 had to be omitted.
2	As Plot 1	Sprayed with atomised sulphur (12 lb. to 100 gallons) combined with each lead arsenate spray	Control of mildew slightly better than Plot 1, otherwise the same.
3	As Plot 1	Sprayed with atomic sulphur (10 lb. to 83⅓ gallons), first application at spur-burst, followed by applications combined with each lead arsenate spray	No damage resulted from this spray, and mildew was effectively controlled on all varieties.
4	As Plot 1	Sprayed with atomic sulphur (10 lb. to 83⅓ gallons), first application at spur-burst, second at pinking, and later combined with each lead arsenate spray	As Plot 3. The extra application at pinking stage did not appear to give any better results.
5	As Plot 1 . .	Check Plot. No fungicide spray used	Mildew developed freely on all varieties excepting Granny Smith, on which it was less evident
6	As Plot 1 .. .	As Plot 3, except that 6 lb atomic sulphur was used to 83⅓ gallons spray	Results not quite as good as Plot 3.
7	As Plot 1	Sprayed with sulphuric acid, 1 to 1,500 by volume (approx ¼ pint to 46⅞ gall.), first application at spur-burst, second soon after blossom complete third five to six weeks later, and fourth four to five weeks later than third	This spray controlled mildew fairly well, and no damage resulted from the first two applications. Slight burning of the leaves of London Pippin followed the third application To test if this was caused by lead arsenate present on the leaves from previous spraying the last application was given fourteen days after the lead arsenate spray (the previous applications having been two days before). This application burnt leaves and fruit of all varieties, London Pippin suffering the most
8	As Plot 1, omitting Rome Beauty	Sprayed with colloidal sulphur, first application at spur-burst, second just after fruit set, third four weeks later than second, fourth about four weeks later than third.	No damage was caused by this spray, and mildew was controlled equally as well as with atomic sulphur.
9	As Plot 8	Sprayed with atomic sulphur (14 lb. to 83⅓ gallons), first application at spur-burst, and later combined with each lead-arsenate spray.	Results slightly better than Plot 3, but it is questionable if the extra strength was warranted by the results.
10	As Plot 8	Atomic sulphur (10 lb. to 83⅓ gallons) combined with lime-sulphur diluted to spur-burst strength; first application at spur-burst, second and later applications diluted to summer strength for apples, combined with each lead arsenate spray.	As Plot 3. The combined spray was as effective in controlling mildew as atomic sulphur alone No black spot on this plot, check plot, or any other part of orchard; hence no deductions could be made as to control of black spot of apples.
11a	Apples.—Stone Pippin, London Pippin, Cleopatra, Buncombe, and Jonathan.	Colloidal sulphur, concentrated (paste) form. Time of application as Plot 8.	No damage was caused by this spray, and mildew was controlled as effectively as with atomic sulphur.
11b	As Plot 11a	Colloidal sulphur paste; first at spur-burst and later combined with each lead arsenate spray.	As Plot 11a.

SPRAYING Experiments at Glen Innes Experiment Farm Orchard—*continued*.

Plot.	Variety of Fruit.	Treatment.	Results and Remarks.
12a	Apples.—Stone Pippin, Granny Smith, Dunn's, London Pippin, Cleopatra, Fameuse, Buncombe, and Jonathan.	Departmental lime-sulphur diluted to spur-burst strength; first application at spur-burst, second at pinking, and later applications diluted to summer strength for apples with each lead arsenate spray.	No damage in the way of dropping the fruit or defoliation was caused by this spray, but the foliage and fruit of the trees in this plot seemed retarded compared with those of the atomic plots. Mildew developed on varieties subject to it, but was slightly less then on check plots. Owing to there being no outbreak of black spot, no results were obtained in respect to that disease.
12b	As plot 12a	Sprayed as Plot 12a, except that pinking stage was omitted.	As Plot 12a.
13a	Apples.—Stone Pippin, London Pippin, Cleopatra, Granny Smith, Buncombe, and Jonathan.	Sprayed at spur-burst with atomic sulphur (10 lb. to 83½ gallons), combined with Bordeaux (6-4-40), and later using Bordeaux (6-4-50) combined with each lead arsenate spray.	This spray again caused considerable damage to leaves and fruit, the latter in some cases being so badly russeted and cracked as to be unsaleable. Mildew was fairly well controlled. No outbreak of black spot.
13b	As Plot 13 a, including Dunn's.	Sprayed at early spur-burst with Bordeaux (6–4–40), followed by lime sulphur as on Plot 12b.	This spray caused some russeting and cracking of Dunn's and some russeting of Cleopatra; otherwise no damage resulted. Mildew was only slightly controlled. No outbreak of black spot.
14a	Apples.—Stone Pippin, London Pippin, Cleopatra, and Buncombe.	Sprayed at pinking with proprietary substitute for lime-sulphur (3 lb. to 50 gallons), and later combined with each lead arsenate spray	No damage Mildew only slightly controlled, though perhaps better than with Bordeaux and lime-sulphur. No outbreak of black spot.
14b	Apples.—Granny Smith, Dunn's, London Pippin, Cleopatra, Buncombe, and Jonathan	Sprayed with Bordeaux (6–4–40) at spur-burst followed by oil (1 in 25) next day	Fruit of Jonathan and Dunn's slightly russeted and cracked, also slight rusting of fruit of London Pippin and Cleopatra. No damage caused to other varieties. This spray did not delay development of woolly aphis or mildew No outbreak of black spot
15	As Plot 12a	Sprayed with Bordeaux (6–4–50) about five weeks after blossoms fall.	This spray caused about one sixth of the leaves of the Dunn's to turn yellow and fall: it also caused some russeting and cracking of Dunn's and Jonathan, and slight russeting of Cleopatra and London Pippin.
16	As Plot 12a	Sprayed with Bordeaux (6–4–50), combined with lead arsenate about five weeks after blossoms fall.	As plot 15.
17	As Plot 12a	Sprayed with Bordeaux (6–4–50), combined with lead arsenate about nine weeks after blossoms fall.	As plot 15, except that russeting was slightly less.
18	As Plot 12a	Sprayed with Bordeaux (6–4–50), combined with lead arsenate about nine weeks after blossoms fall.	As plot 17.
19	As Plot 12a	Check plot. No fungicide spray ...	Mildew developed freely on varieties subject to it, but was less than on check Plot 5. Plot 19 was sprayed last season with Bordeaux and atomic sulphur.
E	As Plot 12a	Sprayed in calyx with lime-sulphur diluted to pinking stage strength for deciduous trees other than apple and pears without lead arsenate, and again towards the end of November. No previous fungicide used.	No damage caused by this spray, fruit setting as well as on check plots.
F	As Plot 12a	Sprayed as Plot E, except that dilution was summer strength.	As Plot E.
G	As Plot 12a	Sprayed as Plot E, except that lime-sulphur at 25 deg. Baumé diluted one volume to 40 volumes of water was used.	As Plot E.
I	As Plot 12a	Sprayed at spur-burst only with lime-sulphur at strength for citrus trees.	As Plot E.
J	As Plot 12a	Sprayed at spur-burst with lime-sulphur diluted to pinking strength for deciduous trees other than apples and pears. No later fungicide.	As Plot E.
K	As Plot 12a	Sprayed as Plot I, except that pinking stage replaces spur-burst.	As Plot E.

SPRAYING Experiments at Glen Innes Experiment Farm Orchard—*continued.*

Plot.	Variety of Fruit.	Treatment.	Results and Remarks.
L	As Plot 12a	Sprayed as Plot J, except that pinking stage replaces spur-burst.	As Plot E
Ma	As Plot 12a	Sprayed with Bordeaux (6-4-40) at early spur-burst only. No later application of any fungicide.	No russeting. Mildew developed more or less freely on all varieties, Jonathan and London Pippin suffering the most, and Dunn's and Granny Smith the least. The amount of mildew was, however, slightly less than on check plots
Mb	As Plot 12a	Sprayed at very early spur-burst with Bordeaux, (6-4-40). No later application of any fungicide.	As Plot Ma.
N	As Plot 12a	Sprayed at early spur-burst with Bordeaux (6-4-50). No later fungicide.	As Plot Ma
O	As Plot 12a	Check plot. No fungicide used ...	Mildew developed more or less freely on all varieties, Jonathan and London Pippin suffering the most and Dunn's and Granny Smith the least.
...	Pears.—Williams ..	Sprayed with lime-sulphur as Plot 12b.	No damage in the way of drop of fruit or defoliation resulted, but the fruit was not as attractive in appearance as on the check plots, and the foliage was retarded in growth.
Ac	Cherries.—Florence, Lyons, St. Margaret, and Black Republican.	Sprayed at pinking stage with lime-sulphur diluted to spur-burst strength for apples and pears.	No damage resulted from the application of this spray.
Bc	As Plot Ac	As Plot Ac except that dilution was strength for citrus trees.	As Plot Ac
Cc	As Plot Ac	As Plot Ac, except that dilution was pinking strength for deciduous trees other than apples and pears	As Plot Ac.
Dc	As Plot Ac	Check plot	... ...
Ec	Cherries.—Lyons, Florence, St. Margaret, and Black Republican	Sprayed soon after setting and again towards the end of November with lime-sulphur diluted pinking strength for deciduous trees other than apples and pears.	The leaves of Capiaumont and Beurre Diel were slightly burnt by first application and fruit of Capiaumont russeted. No damage to cherries
Fe	Pears.—Capiaumont and Beurre Diel.	... ...	... ...
Fc	As Plot Ec	As Plot Ec, except that dilution was summer strength for apples and pears	As Plot Ec
Gc	Pears.—Capiaumont and Beurre Diel.	Sprayed at pinking stage with lime-sulphur diluted according to spur-burst strength for apples and pears	No damage. No black spot.

SOME RECENT PUBLICATIONS.

THE following new or extensively revised Farmers' Bulletins have been added to the Department's list within recent date :—

No. 16, Manures and Manuring (Sixth Edition). Price 1s. 1d.
No. 58, Hides, Skins, and Sundries (Second Edition). Price 10d.
No. 72, Spraying (Sixth Edition). Price 1s. 1d.
No. 99, Fungus and Other Diseases of Apple and Pear (Second Edition). Price 10d.
No. 129, The Beginner in Bee Culture (Second Edition). Price 10d.
No. 137, Safeguarding Farm Stock from Disease. Price 10d.
No. 139, The Culture of Sugar Cane in New South Wales. Price 10d.
No. 140, The Pruning of the Vine. Price 10d.
No. 143, Producing Lucerne Hay under Irrigation. Price 10d.

Each of these publications is obtainable, post free, at the prices indicated, from the Government Printer, Phillip-street, Sydney.

New Standard Numerical Pack for Apples.

W. J. ALLEN and W. LE GAY BRERETON.

WHEN the Canadian apple case—or, to describe it more accurately, the modified Canadian apple case, for one-eighth of an inch was added to its width to give it the Imperial bushel capacity—was adopted by New South Wales as one of the standard bushel containers, the Canadian charts for the 2-2 pack with four tiers and the 3-2 with five tiers were also adopted, and a 3-3 pack with six tiers was added for the smaller sizes of fruit. This case has been extensively made up with a hinged lid and used by our citrus-growers to take the place of the old gin-case, and for oranges and lemons the three packs just referred to have proved quite satisfactory. For the maintenance of the four, five, and six tiers and their respective packs for apples, however, considerable flat packing has had to be resorted to. As flat packing is not suited to apples, experiments have been carried out by the Department (principally by Mr. W. W. Cooke, Orchardist at Glen Innes Experiment Farm), with a view to devising a pack that eliminates the necessity for flat packing, and as a result a new standard pack has been designed. One or two of the counts in this pack still require further proving, for a peculiar feature of such tests is that the size of fruit required for a certain count will happen to be scarce again and again. If this occurs anywhere but at the end of a sequence it does not matter, as if the counts above and below such a count pack out correctly it is sufficient proof that the intermediate count is also correct. When the untried count is at the end of a sequence, however, or in other words, if it occurs at the change from one pack to another, it requires proving by several trials.

It is most probable that another packing season will clear up these doubtful points, and in the meantime it is thought advisable to publish the new charts, in order that packers may take advantage of a method that eliminates at any rate most of the flat packs and still adheres to a standard. In the new charts the 3-2 is a four-tier pack and the 3-3 a five-tier pack. They run as follows, and absorb approximately sizes from 2¼ inches to 3 inches:—

Tiers.	Pack.	Row Count.	Total Count.	Placing.
4	3-2	5-5	100	On edge.
4	3-2	6-5	110	,,
4	3-2	6-6	120	,,
4	3-2	7-6	130	,,
*4	3-2	7-7	140	,,
†5	3-3	5-5	150	,,
5	3-3	6-5	165	,,
5	3-3	6-6	180	,,
5	3-3	7-6	195	,,

* Requires further testing; may prove rather low.

† Has been tested with Cleopatra apples, but requires further proving for flat-type apples.

As indicated in the footnote to the above table, the 3—2 x 7—7 requires further proving, as does also the 3—3 x 5—5 if with any varieties these counts fail; if only one of the counts fail there will be a gap in the sequence of counts between the 3-2 and 3-3 packs, which would necessitate resorting to one or two counts packed flat, either in the 3-2 with five tiers or in the 3-3

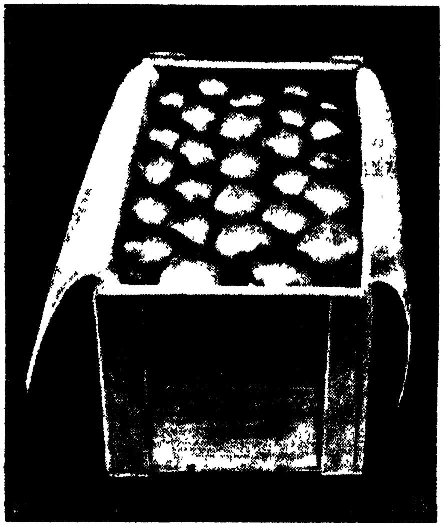


Fig. [illegible].—Showing the 3-2 x 6-5 four tier (110) pack for apples.

Note that the top tier starts with two and closes with two. A better appearance would result if the first tier were started with two, then counts with unequal numbers in the longitudinal rows (such as 6–5, 7–6, etc.) would start with three and close with three. As there are four tiers this would make no difference to the total count

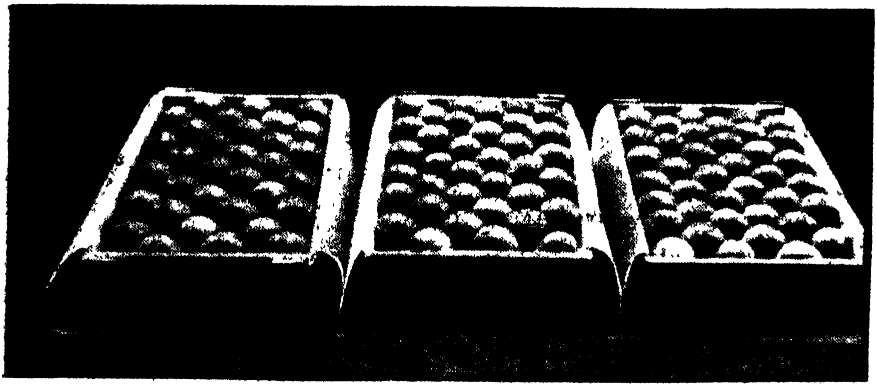


Fig. 2.—Three Useful Packs.

Showing on the left the 3-3 x 6-5 five tier (165) pack; in the centre the 3-3 x 6-6 five tier (180) pack; and on the right the 3-3 x 7-6 five tier (195) pack. The photo was taken with the cases on a packing table, hence their apparent shallowness.

with six tiers. Even in the event of such a break, however, use of the new chart will do away with the greater part of the flat packing.

Although lower counts than the 3-2 x 5-5 were not tried out in these tests, it is probable that with some varieties the 3-2 may be extended in that direction at least another count. When, owing either to the apples being too large for the width of the case to make a 3-2 pack or so big as to pack too high, the change must be on to a 2-2 pack in four tiers. In the higher counts of the 2-2, it will be obvious, the fruits would need to be packed flat, as they would not come up in three tiers, and if they were too high in four tiers 3-2 they would pack still higher in four tiers 2-2. That these few counts of the 2-2 must still remain flat is of very little consequence, however, as the sizes absorbed by these counts would measure well over 3 inches, which sizes should form only a small proportion of a crop from full-bearing trees and are not of high commercial value.

When packing the four-tier 3-2 it can be started 2-3 instead of 3-2. This will not alter the count, as there is an even number of tiers, and with those counts with unequal numbers in the longitudinal rows (such as 6-5 and 7-6) the top tier will then start with three apples and close with three, which will result in a better appearance if the case is opened on that side than if the exposed tier were started with two apples and closed with two, as would be the case in such counts if the first tier were started with three apples in the ordinary way.

It might be mentioned that it will be found, as in other charts, that apples of greatly differing shape will change on different parts of the chart. For instance, a very flat-type apple may easily come down on to the 140 count of the 3-2 and start on the 165 count of the 3-3, whereas long types will perhaps only come down to the 130 count of the 3-2 to start in on the 150 count of the 3-3. Again, the chart may require extending another count to 7-7 in the 3-3 for flat types.

Judging from a conversation with a grower recently returned from Washington, U.S.A., in some sections of the United States packers appear to have departed from the flat packing of apples in the Canadian case, but to have retained the four tiers in 2-2, five tiers in 3-2, and six tiers in the 3-3 by packing "edge open," that is, placing the apple with the calyx pointing directly towards one end of the case and the stalk towards the other. There is certainly one argument in favour of such placing, in that in naked packing stalk injury is avoided, as the stalk is allowed space and does not come up against another apple as in "angle-placing" or "closed" packing. Against this advantage must be considered the fact that an open pack is liable to slip out of place while the first tier is being put in, while it is certainly a slack pack with an unfavourable appearance to the eye of the buyer, and a pack requiring a more excessive spring or bulge than the closed or angle-placed pack. Moreover, stalk injury can always be prevented by efficient wrapping, and in no circumstances should apples intended for long-distance transport be packed unwrapped.

Black Spot of Pear and Apple.

SOME ORCHARD EXPERIMENTS.

W. LE GAY BRERETON, Assistant Fruit Expert, C. O. HAMBLIN, B.Sc., B.Sc. Agr.,
Assistant Biologist, and W. B. STOKES, Orchard Inspector.

EXPERIMENTS have been conducted for three years past in the orchard of Mr. W. King, Turramurra, for the control of "black spot" of pear These experiments were carried out with the co-operation of Mr. King and under the direction of Mr. Stokes, whose report on the field work at Turramurra follows.

Report on Black Spot Experiments at Turramurra.

The experiments at Mr. King's orchard, Turramurra, were commenced in 1917 because a great number of Williams pear trees were being cut down in the district, the growers stating that they were unprofitable on account of black spot. While the planting of these fruit trees cannot generally be recommended on the coast, still, where they are established and crop well, they will pay as well as the average fruit tree, provided the fruit is clean and is marketed before the Victorian fruit arrives here, which is about the middle of January. It is no use waiting until the fruit is fully matured. The time to dispose of it is limited. When the pears are large enough they are fit, and prices ranging from 10s. to 16s. are then obtainable. During the last season (1921), which is considered one of the worst gluts on record, 8s. and 9s. were obtained for fruit marketed on 11th January.

The sprays used in these tests were lime-sulphur and Bordeaux mixture. The lime-sulphur was made according to the Department's formula (see "Spray Leaflet No. 3"), testing 25 degrees Baumé, and was applied on the day on which it was made. It was tested for two years only. It was quite evident then that Bordeaux mixture was giving far better results in controlling black spot, and also that serious burning of the leaves occurred on the trees in this test (and also in other orchards) where lime-sulphur had been used. Lime-sulphur sprays were therefore discontinued, and additional tests were made with Bordeaux at weaker strengths. The lime-sulphur has not the objectionable habit of russeting the fruit like Bordeaux, and in order to overcome this objection in the later stages of the experiment the Bordeaux was reduced in strength from 6—4—40 to 6—4—50, and then to 6—4—60. As was partly expected, all strengths produced a certain amount of russeting. In the experiment planned for the coming year still greater dilutions are to be tried, but no great promise of freedom from russet can be entertained. In comparing the results appended, it will be seen that different strengths of Bordeaux were used throughout, and that the weak solution gave results in the control of black spot equal to those given by the strong solutions. This may not have been entirely true for the season 1920-21, but it certainly was for the season 1919-20, black spot being exceptionally prevalent in that season.

STRENGTH of Mixtures and Stages of Application.

Sprays used	Stages of Application.	Strength.
Lime-sulphur A (testing 25 degrees Baumé).	1. When a little more than half of the spurs were bursting.	1 gallon of concentrated lime-sulphur to 27 gallons of water.
	2. When most of the blossom buds were showing colour.	Same as above.
	3. When the fruit had set and along with calyx arsenate of lead spray.	1 gallon of concentrated lime-sulphur to 36 gallons 5 pints of water.
Lime-sulphur B	1 and 2, same strengths and times as in 1 and 2 of lime-sulphur A.	... .
	3. When the fruit had set and along with calyx arsenate of lead spray.	1 gallon of concentrated lime-sulphur to 41 gallons of water.
Bordeaux mixture A.	1. When a little more than half the spurs were bursting.	6 lb. copper sulphate, 4 lb. lime. 40 gallons of water.
	2. When most of the blossom buds were showing colour	6–4–40.
	3. When the fruit had set and along with calyx arsenate of lead spray.	6–4–50.
Bordeaux B	1. When most of blossom buds were showing colour	6–4–40.
	2. When the fruit had set and along with calyx arsenate of lead spray	6–4–50.
Bordeaux C ...	1, 2, and 3, same times as in Bordeaux A.	6–4–50 throughout.
Bordeaux D ...	1 and 2, same times as in Bordeaux B	6–4–50 throughout.
Bordeaux E ...	1. Seven days before spur-bursting (estimated).	6–4–22.
	2. Advanced spur-bursting (odd flowers in full bloom).	6–4–50.
	3. When fruit had set and along with calyx arsenate of lead spray.	6–4–50.
Bordeaux F ...	1. Advanced spur-bursting (odd flowers in full bloom).	6–4-50.
	2. When fruit had set and along with calyx arsenate of lead spray.	6–4-50.
Bordeaux G ...	1. Seven days before spur-bursting (estimated).	6–4-22.
	2. Advanced spur-bursting (odd flowers in full bloom).	6–4–60.
	3. When fruit had set and along with calyx arsenate of lead spray.	6–4–60.
Bordeaux H ...	1 and 2, same times as in Bordeaux F	1 and 2, 6-4-60.

Results.

Sprays used.	No. of Applications.	* Dates of Application.	No. of Fruit.	Clean Fruit.		Spotted Fruit.	
				No.	Per cent.	No	Per cent
Season, 1918–19—							
Lime-sulphur—A	3	18th and 27th Sept., 18th and 23rd Oct.	341	160	46·9	181	53·1
,, B	3	Same as above	258	113	43·4	145	56·6
Bordeaux- A ..	3	,, ...	3,479	3,159	90·8	320	9·2
,, B ...	2	27th Sept., and 18th and 23rd Oct.	2,312	2,165	93·6	147	6·4
Check trees No. 1 (unsprayed).	None.	....	655	8	1·2	647	98·8
Check trees No. 2 (unsprayed).	,,	....	236	185	78·3	51	21·7
Season, 1919–20—							
Bordeaux—A ..	3	20th Sept., 26th and 27th Sept., 20th Oct.	9,043	8,314	92·1	729	7·9
,, B ..	2	26th and 27th Sept., 20th Oct.	1,686	1,643	97·3	44	2·7
,, C ..	3	Same as Bordeaux A	5,140	4,886	95·1	254	4·9
,, D ...	2	Same as Bordeaux B	3,903	3,658	93·3	245	6·7
Check trees No. 1 (unsprayed)	...	....	2,934	1	0·03	2,933	99·9
Check trees No. 2 (unsprayed).	..	....	279	2	0·7	277	99·3
Season, 1920–21–							
Bordeaux -E ...	3	14th and 29th Sept., 20th Oct.	3,257	3,217	98·7	40	1·3
,, F ..	2	29th Sept., 20th Oct....	4,014	3,959	98·6	55	1·4
,, G ..	3	Same as Bordeaux E ...	4,787	4,743	99·1	44	0·9
,, H ...	2	Same as Bordeaux F ..	1,444	1,433	99·2	11	0·8
Check trees No. 1 (unsprayed).	..	.. ..	315	46	14·6	269	85·4
Check trees No. 2	...	... .	496	352	70·9	144	29·1

* The dates of application of the sprays given are not necessarily applicable to other localities. The exact stage of application is more correctly judged by the condition of the spurs and blossom buds. The dates of application are given as a guide only, and for purposes of comparison from year to year. They show that, at least during the years of this experiment, identical conditions of the spurs, blossom buds, and the setting of the fruit, practically fell on the same dates each year.

Comparisons disclose no material difference between the blocks sprayed twice and those sprayed three times. It is noteworthy also that variations of the time of spraying from the spur-bursting stage to the colouring of blossom buds have given practically equal results. Further, no spraying was made later than when the fruit had set, and although there is no data to show whether any beneficial results would follow later spraying, judging by the results obtained no material difference would be observed. It is fairly safe to assume that Bordeaux, at the strength 6—4—50, applied when most of the blossom buds are showing colour, and again (6—4—50) when the fruit has set, and along with the calyx spray with arsenate of lead (viz., D in the appended table), would give effective control on the coast.

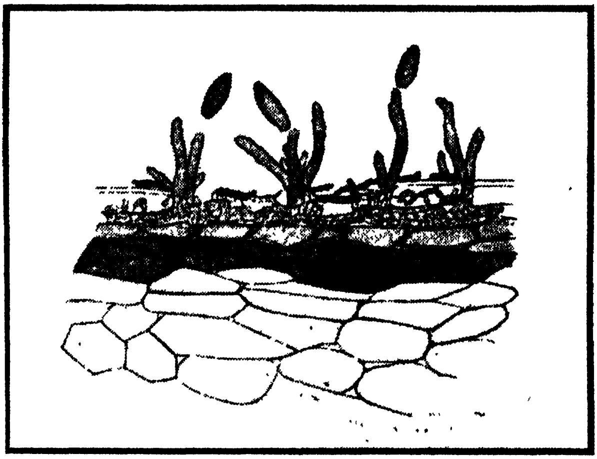
The strengths of mixtures, stages and dates of application, and the results are tabulated. It will be noted that no results have been given for the season 1917-18, there having been an almost total failure of the crop, and therefore no count of the fruit.

It is interesting to note that very little variation occurs in the dates from year to year of the swelling of the spurs, and of the other features right on to the setting of the fruit. The dates of spraying in the accompanying table help to illustrate this point.

Two sets of unsprayed check trees were provided for, in order that comparisons might be made, No. 1 being on low land and No. 2 on high land.

The Ascospore or Wintering Stage of the Fungi.

When these experiments were being discussed and replanned in 1920 it was suggested by the Biological Branch that some attempt should be made to find the wintering stages of apple scab and pear scab, more commonly known as "black spot." The summer stage of the fungus (*Fusicladium*) has long been known in New South Wales, and it is with the rapid spread of the "black spot" by this agency that the fruitgrower has to contend, his spraying operations being designed to prevent its progress. The summer spores, however, were thought to represent only one phase of the disease, and the wintering stages of the fungus, if they existed, were probably playing a part in the reinfection of the foliage and fruit in the spring. Accordingly, by arrangement with the orchard inspectors, specimens of pear leaves which had fallen from trees showing "black spot" in the previous year were submitted to the branch in the month of September, 1920.



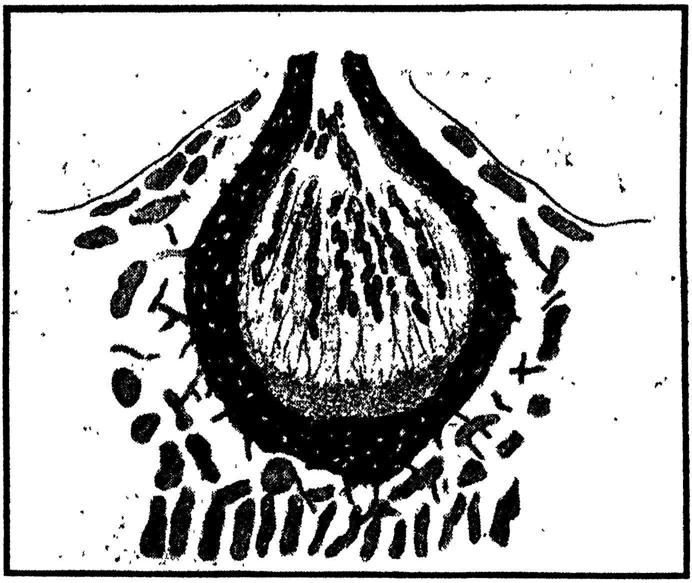
Conidial stage: Fusicladium of the Pear Scab Fungus.

[*After Duggar.*]

Venturia pirina, which is the true wintering stage of the pear scab, was found to be quite abundant on leaves submitted by Mr. Hunter (Inspector, Castle Hill district) and Mr. Gallard (Inspector, Ryde district), and on leaves obtained by Mr. Stokes, from Turramurra, thus showing a wide distribution of this stage of the fungus, at least in the vicinity of the metropolis.

Leaves of apple collected at Towrang (Goulburn district) in August, 1920, were also found to contain *Venturia inæqualis* when examined.

The significance of these discoveries and the record of these stages of the fungus in New South Wales is perhaps not of great immediate value to the orchardist, but it does make clear the fact that the disease probably overwinters normally in this way. We have reason to suspect that it may overwinter on the trees as well as on the fallen leaves. Severe twig injury due to scab has been recorded in other parts of the world, and the summer conidial stage (*Fusicladium*) has been found to persist in the twigs throughout the winter.*



Venturia Pomi, from wintered leaves of apple.

[*After Duggar.*]

While these stages of the fungus have been known for some time in America, they have not previously been recorded here, partly, no doubt, owing to the fact that no searching examination of fallen leaves affected with black spot have been made in the spring.

To enable the grower to deal with the fungus in this stage it is important to plough in all fallen leaves during the winter, and to avoid bringing them to the surface by stirring the soil in the warm, moist days of spring.

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* See "Overwintering of 'Apple Scab' Fungus," W. P. Fraser, "Science," n.s., 46 (1917), No. 1186, pp 280-282. and E.S.R., Vol. 38, No. 2, Feb., 1918, p. 151.

Every orchardist should endeavour to complete his ploughing operations prior to the swelling of the buds. If the outbreak of black spot is delayed it is far easier to combat with appropriate spraying.

Relation of Weather Conditions to Black Spot.

Records were kept of the weather conditions prevailing during the progress of the spraying experiment in Williams pears at Turramurra, an ordinary wet and dry bulb thermometer being used.

During the months of September and October, 1920, readings taken at 12 noon daily ranged from 62 degrees Fah. to 100 degrees Fah., the 100 degrees being attained only once, viz., 11th October, which was a particularly *dry* day, the humidity being only 13 per cent. Only twice in those two months did the humidity exceed 50 per cent. at noon, viz., 25th October, 51 per cent., and 28th October, 72 per cent. During the critical weeks from 14th September (when the very early spray, prior to spur-bursting, was applied) to 20th October (when the fruit had set), the five highest humidities recorded were 19th September, 42 per cent., 28th September, 33 per cent., 2nd October, 37 per cent., 13th October, 38 per cent., and 16th October, 49 per cent., and the lowest humidity 30th September, 9 per cent. These figures indicate the exceptionally dry atmospheric conditions prevailing just at the time when the discharge of ascospores from the asci on the leaves could have been expected. It has generally been recognised that a wet spring results in a greater amount of infection and spotting of the fruit.

The fact that one of the check trees (unsprayed) gave only 29 per cent. of spotted fruit is directly related to the dry weather prevailing at the spur-bursting stage. The humidity percentages during November and December were higher throughout than in the early months of growth.

The relation between prevailing spring weather conditions and the amount of infection occurring on fruits during the year has been studied in America, where it was found that a spray applied when the maximum discharge of ascospores was occurring gave excellent results, this being usually before the separation of the blossoms in the clusters.*

The Department is greatly indebted to Mr. W. King, of Turramurra, for his continued co-operation in connection with these experiments, and for his assiduity in recording the temperature readings.

Later Experiments with Black Spot of Pear.

As previous experiments had demonstrated the value of Bordeaux sprays for the coastal grown Williams pears, it was decided to attempt the control of the spot this season (1921—22) with greater dilutions of Bordeaux mixture than those previously employed. The experiment was carried out as before at Turramurra.

The sprays used were Bordeaux mixture, 6—4—50, 6—4—80, and 6—4—100, and "Pickering" Bordeaux, unsprayed trees being left as controls. The Pickering Bordeaux was made by dissolving 3 lb. bluestone in a small quantity of water (approximately 60 fluid oz.) at a temperature of 140 degrees Fah., and adding it to 48 gallons, 1 quart, 8 fluid oz. of lime-water (saturated), then diluting to 50 gallons with water. Two applications of the sprays were made. The second sprays were applied on 26th and 27th September. The spurs were then well advanced—some out in full bloom and others in all stages down to the swelling of the spurs.

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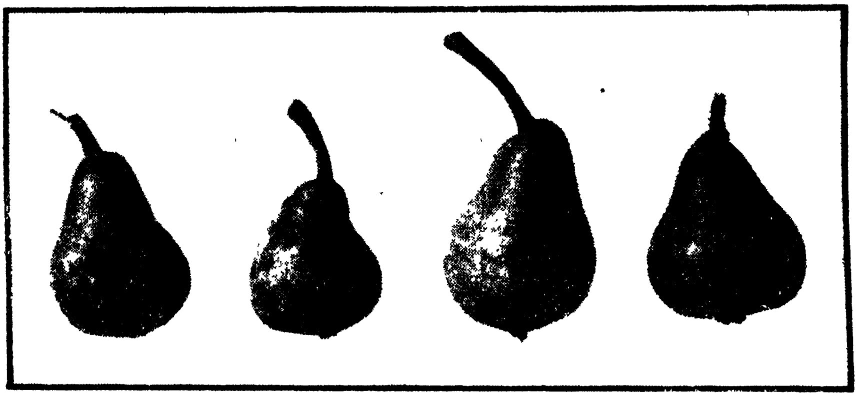
* A preliminary report on "Apple Scab and its control in Wisconsin," G. W. Keitt, Phytopathology, Vol. 10, No. 1, page 58, January, 1920.

An examination of the trees was made on 23rd December, 1921. All the sprays gave good control.

It was thought on a close examination that the 6—4—100 spray was slightly less effective than 6—4—50 and 6—4—80. The control of the disease by Bordeaux 6—4—80 was all that could be desired. When a comparison was instituted with the unsprayed trees, it was found that whereas these check trees contained about 90 per cent. of fruit badly spotted, the sprayed trees in each case had less than 5 per cent. of spotted fruit. The crop on all the trees was a heavy one, and the season proved to be very favourable to the "black spot" disease, with the resultant spotting on unsprayed trees.



Spraying Pays.
On the left, pears from unsprayed trees (spotted); on the right, pears from trees sprayed with Bordeaux mixture, 6-4-80 (clean).

A comparison of the relative amount of russeting produced by the sprays showed that while 6—4—50, 6—4—80, and 6—4—100 Bordeaux marked the fruit very lightly, the Pickering Bordeaux was rather more severe. In all cases, however, there was a slight amount of russeting, but not enough in any way to interfere with the value of the fruit. The experiment undoubtedly indicated that a dilution of the Bordeaux to 6—4—80 strength gave effective control of the disease.

Black Spot of Apple.

A series of sprays for the control of this disease was tested in 1920-21 at the orchard of Mr. H. A. Mills, Towrang. Atomic sulphur, lime-sulphur, and Bordeaux mixture were all tried, in some cases early applications being given, and in others combined with the lead arsenate sprays for codlin moth. Trees of the following varieties were used:—Granny Smith, Cleopatra, Delicious, Mackintosh Red, Carpenter—amounting in all to 100 trees.

As the amount of black spot disease was very limited, no conclusions regarding its control by the sprays could be drawn.

The use of Bordeaux, 6—4—50, on the fruit, particularly where two applications were given, resulted in serious russeting. This has been the general experience with Bordeaux sprays on the tablelands. Lime-sulphur sprays did not give rise to russet, but their ability to completely control black spot cannot yet be said to have been demonstrated.

At present the Department makes the following recommendations for the control of black spot of apple and pear:—

Control.—Plough in all fallen leaves in the autumn when these are shed. It is inadvisable to work the ground in the spring at the time of flowering, as this helps to spread the spores. Prune out and burn all dead wood.

Spraying.—At least three sprayings seem to be necessary for effective control. They may be suitably combined with the arsenate of lead spray for codlin moth. The following programme is recommended as the most likely to give complete control:—

1. Spray with Bordeaux (6—4—50) or lime-sulphur (spur-bursting strength), at from spur-bursting to pinking stage.
2. Lime-sulphur or Bordeaux mixture (summer strength) when the petals are falling; this second application to be combined with the first arsenate of lead spray for codlin moth. This application is specially important when showery or wet, muggy weather occurs at this stage. Lime-sulphur should not be used on Trevitt apples after the spurs have burst.
3. Lime-sulphur or Bordeaux mixture (summer strength), combined with the second application of arsenate of lead, if weather conditions favour the disease.
4. Lime-sulphur or Bordeaux mixture (summer strength), combined with the third application of arsenate of lead, if weather conditions favouring the disease continue.
5. Spray in autumn with Bordeaux mixture, winter strength (6—4—22), before the leaves have fallen, but after the picking of the fruit. This is particularly important when the disease conditions have been bad during the season; it is also valuable as an insurance for next season, since it has been found that spores on the autumn leaves carry over the disease.

N.B.—Bordeaux mixture is liable to produce russeting in apples if used after the early spur-bursting stage, but experiments so far indicate that it causes very little russeting when applied five weeks later than the falling of the petals. It is not advisable to spray Trevitt apples or coastal-grown Williams pears with lime-sulphur after the spur-bursting stage.

Dusting versus Spraying as Factors in Cleaner Fruit.

THE Department has from time to time received from the United States Department of Agriculture reports on dusting for the control of insect pests and fungus diseases affecting fruit, but up to the present the reports received have not been of a nature sufficiently convincing to warrant the expense of carrying out experiments in dusting in this State. A publication entitled " The Present Status of Dusting,"* however, proves more comprehensive than any report previously received, and it is thought that some extracts from it will be of interest to local orchardists. It was brought under the Department's notice by Mr. E. K. Wolstenholme, Lecturer on Fruit Growing, University of Sydney.

Professor Whetzel has collected data from many parts of the United States of America and from Canada, both from direct experiment field trials and from growers who have adopted the practice of "dusting" in place of spraying for the control of some fruit pests and diseases.

Notwithstanding this fact, he refrains from expressing a definite opinion whether dusting should supersede spraying. In his opening remarks he says:—"No intelligent and practised grower or expert would argue as yet that dry materials as such are more effective than liquid sprays. That their successful application in dry form assures certain distinct advantages of decided economic value everyone has appreciated and acknowledged from the beginning--greater rapidity of operation and consequent saving of valuable time and expensive labour; more timely application, and, therefore, more uniformly effective control; elimination of the undesirable waterhaul and its attendant difficulties. All these have been acknowledged without question or debate.

" Upon what grounds, then, have you hesitated, upon what features of the method have you debated and demanded evidence? I believe that I am correct in saying that these are primarily two—effectiveness of dusting as compared with spraying, and cost of dusting as against spraying. These chiefly are the questions upon which a general abandonment of spraying in favour of dusting hangs. Then let us examine the data and the opinions accumulated since the revival of dusting in 1912."

Results with Apples.

The writer then gives results in tabulated form of experiments in the control of apple scab or black spot and codlin moth with sprays and dust at New York, Michigan, Nova Scotia, and Illinois. In the first two states the dusts used were dust sulphur and lead arsenate, and the sprays used were lime-sulphur and lead arsenate. In the latter two states lime-sulphur and lead arsenate, or Bordeaux mixture and lead arsenate, were the sprays used, and the dusts used were the same as in the first two.

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* Paper read by H. H. Whetzel, Professor of Plant Pathology at Cornell University, before the New York State Horticultural Society, Rochester, N.Y.

The following table presents the average results of the experiments in the four states named. It should be stated, perhaps, that these averages necessarily fail to show certain facts that came to light in specific years in the course of the experiments, but the following statement of Mr. Whetzel sums the matter up as to apples:—

Region	No. of years.	No. of Experiments.	Unsprayed			Sprayed			Dusted.		
			Scabby Fruit	Worm-infested Fruit	Sound Fruit	Scabby Fruit.	Worm infested Fruit.	Sound Fruit.	Scabby Fruit.	Worm-infested Fruit.	Sound Fruit.
			Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent	Per cent
New York .	4	11	43·2	22·0	14·3	11·4	7·8	65·9	12·2	5·0	70·0
Michigan .	4	7	71·4	12·0	19·7	20·9	0.4	78·4	20·8	0·07	78·8
Nova Scotia ..	3	4	49·7	6·8	43·6	8·9	2·9	87·0	5·9	1·4	91·2
Illinois ..	4	7	70·4	44·7	11·8	19·1	8·8	60·1	10·9	8·5	58·6
Average of .	15	29	56·2	21·4	22·4	15·1	5·0	72·0	14·7	3·8	74·7

"The averages shown by such as series of data may be, I believe, regarded as reasonably safe and convincing. What do they show?

"(*a*) On scab control, an average of 56 per cent. scabby fruit on unsprayed trees, reduced to 15 per cent. by spraying and to 14.7 per cent., practically the same, by dusting.

"(*b*) On the control of codlin moth, an average of 21 per cent. wormy fruits on unsprayed trees, as against 5 per cent. on sprayed and 3.8 per cent. on dusted.

"(*c*) As to sound fruit, the unsprayed trees yielded but 22 per cent. on the average, while spraying gave 72.0 per cent. and dusting 74.7 per cent.

"In the face of such evidence, gentlemen, who could draw any other conclusion than that, so far as experimental evidence is concerned, dusting has proven quite as effective in the control of apple scab and codlin moth as has spraying."

The author of the bulletin under review then proceeds to quote the opinion of growers, which he had obtained by means of a questionnaire addressed to all duster owners in the State of New York whom he could locate. The answers he classifies in the following manner:—

Did you dust your apples this past season?—Yes, 73.
Did dusting control scab as well or better than spraying?—Yes, 49; No, 9.
(Three were in doubt, 12 did not answer).
Did dusting control codlin moth as well or better than spraying?—Yes, 51; No, 6.
(Two were in doubt, 14 did not answer).
Will you dust apples next season?—Yes, 68; No, 4.
(One in doubt).

The author states that up to the present there seems to be no published data of an effective contact dust for "sucking" insects of apple trees. He mentions a so-called "black leaf 40 dust" that was developed in California for aphis on walnuts, and that there have been some promising results with its use on apple aphis in Nova Scotia.

Still, even should a contact dust be found equal to the present contact spray for dealing with the soft-bodied sucking insects, such as aphis, there still remains the scale insects, such as San José and mussel scale.

Peaches.

Experiments have also been conducted in several states in the dusting of peaches for the control of freckle (peach scab), brown rot, and curculio. The last-named (an insect pest) is not of such direct interest in New South Wales, as it does not occur here, but the work is nevertheless indicative of the efficiency or otherwise of dusting for the control of an insect pest. The experiments dealt with by Mr. Whetzel were conducted in the States of Georgia, Virginia, and West Virginia, and his summary may be presented in his own way:—

Region	Unsprayed.				Sprayed.				Dusted.			
	Scabby Fruit.	Brown Rot Fruit.	Curculio-infested Fruit.	Sound Fruit.	Scabby Fruit.	Brown Rot Fruit	Curculio-infested Fruit.	Sound Fruit	Scabby Fruit.	Brown Rot Fruit	Curculio-infested Fruit.	Sound Fruit.
	Per cent	Per cent	Per cent	Per cent.	Per cent	Per cent	Per cent	Per cent.	Per cent	Per cent	Per cent	Per cent.
Georgia	65·3	7·5	38·5	31·7	12·3	0·9	4·2	82·7	4·8	2·8	4·2	88·5
West Virginia	69·1	37·6	38·0	14·3	46·0	17·5	44·1	30·0	27·8	20·0	43·0	34·1
Virginia	60·3	15·0	2·9	30·8	.	.	.		10·9	9·2	1·5	83·8
Average	64·9	20·1	26·5	25·6	29·2	9·2	24·2	56·4	14·5	10·7	16·2	68·8

Note.—Unfortunately, no sprayed plots were carried in the Virginia experiments.

The author quotes Mr. Chase, of the State Entomologist's office, in his report on the Georgian experiments in 1919:—"Brown rot, scab, and curculio worked with unprecedented destructiveness. Dusting failed in a number of cases to give satisfactory control. But its failure was no more marked than that of the standard spray schedules. Some of the best fruit produced in the State came from dusted orchards."

This report, as regards brown rot, is of special interest to the coastal growers of New South Wales, as experiments carried out by the Department for some seasons back have failed to reveal any reliable treatment for the control of brown rot in stone fruits.

There is no report of any work in connection with dust for the control of peach leaf curl in the publication under review.

Relative Costs of Dusting and Spraying.

After mentioning that it is most difficult to obtain satisfactory data on the relative costs of dusting and spraying, the writer states:—"I think it is fair to say that a survey of reported figures on the cost of dusting compared with that of spraying gives the impression that, considering materials and labour only, one is about as expensive as the other."

It will be noticed that, except in the case of brown rot of peach, there is no claim at present that dusting is superior to spraying in controlling the diseases or pests mentioned, so that the whole question depends on which method is the cheaper or the more convenient to use. From the previous reports referred to the deductions in this respect were:—

That though dusting is a quicker operation than spraying (which is often of great importance in the control of a disease or pest, apart from the matter of economy), the time available for dusting is more limited than for spraying, as the former operation requires far calmer weather conditions than the latter; that the cost saved by the quicker operation was offset in the experiments by the larger amount of material used. If dusts could be found that would efficiently take the place of sprays they would have a decided advantage in districts where a suitable supply of water for spraying is short.

Though in the experiments quoted in Mr. Whetzel's paper only the same number of applications of dust as sprays were made, it seems likely that the adhering property of dust under some circumstances would be inferior to that of a corresponding spray, and that a greater number of dust applications might be necessary.

That this is actually so in some cases is apparent from the following quotation from an article on the control of red spider in the May-June, 1921, number of the Monthly Bulletin of the Californian Department of Agriculture:—

"*Dusting with Dry Sulphur.*—This form of application has been advocated commonly, but in the last two years has been less successful than formerly in some localities. It has the advantage of speed, it being possible to cover 20 or 30 acres a day with a power blower, *but since two or more treatments are usually necessary dusting may finally require as much time as liquid spraying.*

"In the case of windy weather it is difficult to apply sulphur as a dust thoroughly, and there is a tendency for the material to shatter off the leaves, which lessens efficiency."

No reference has been made by Mr. Whetzel to the use of spreaders in sprays. It is possible that by the development of spreaders a better distribution of spray material on the plants would make sprays far more effective than dusts.

In the foregoing extracts dusting has only been considered as a substitute for spraying. It remains to be seen whether in some cases of disease or insect control dust may prove superior to spray. The development of dusting machinery may make some old methods that have been successfully used in a small way practicable on a larger scale.

Fine ashes or air-slaked lime, for instance, are most effective in keeping pumpkin beetles from attacking pumpkin and melon vines, &c., if such vines can be kept constantly covered. With effective machinery this might become possible on larger areas.

And a dust deterrent may become the means of saving fruit trees or fruit from attack by some insects, such as the Rutherglen bug or the *Monalepta rosæ* beetle, which breeds elsewhere but invades the orchard with a continuous supply of reinforcements, and thus renders the use of poison or contact sprays ineffectual.

Poisoning of Cattle by Sorghum and Allied Plants.

H. WENHOLZ, B.Sc. (Agr.), Inspector of Agriculture.

So comparatively frequently does poisoning due to the prussic acid in sorghum, Sudan grass, or Johnson grass exercise the attention of dairy-farmers in some part of the State that any authoritative contribution on the subject is of interest. A study of the literature of the subject by H. N. Vinall (Bureau of Plant Industry, U.S. Department of Agriculture) presents the matter so clearly that no apology need be offered for making some brief extracts and observations. *

Although deaths among cattle due to eating sorghum had occurred in India several years before, it was not until 1902 that the presence of hydrocyanic or prussic acid in sorghum plants was discovered. In 1903 it was established that this poison exists in the form of a glucoside called dhurrin, from which prussic acid is liberated by an enzyme, with the aid of the digestive juices of the animal. From a comparison of the amount of prussic acid set free from given quantities of sorghum and Sudan grass with the amount of combined acid required to produce fatal results, the quantity of fresh young Sudan grass which an animal would need to eat for the effect to be fatal has been estimated at 19 lb., and of fresh young sorghum at 7½ lb. These figures are based on the assumption that all the acid in the glucoside is set free in the animal's stomach. Fortunately, however, conditions are against the complete liberation of the acid, and the amounts mentioned can be eaten, and have been eaten with impunity.

Investigation and ordinary farm practice have shown that, when cured as fodder or hay, or even so long as they have been allowed to wilt for twenty-four hours after being cut, sorghum and Sudan grass may usually be fed to stock with safety. It has been proved that comparatively large quantities of these fodders may be fed thus without producing any signs of poisoning. This apparent harmlessness of cured or wilted sorghum and hayed Sudan grass is attributed to the destruction of the activity of the enzyme on being dried. Another general experience has been that sorghum or Sudan grass injured by drought or other adverse climatic conditions contains a larger quantity of prussic acid than when the crop has made vigorous normal growth. This point has also been verified by the results of actual chemical analysis, more than twice the quantity of prussic acid being found in sorghum stunted by drought or injured by frost than in sorghum of normal growth.

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* *Journal of the American Society of Agronomy*, Vol. 13, Nos. 6 and 7, September and October, 1921.

On the other hand, it has been shown that sorghum grown on poor soil contains less prussic acid than that grown on a rich soil, especially if the poor soil is low in nitrates. It is nécessary, therefore, to make this clear distinction: that the prussic acid content of sorghum is increased by injury due to drought, but is actually decreased through stunting of the crop due to lack of nourishment.

That the percentage of prussic acid in sorghum decreases steadily from the time the plant begins growth until it ripens seed (presuming the growth has been normal) is generally agreed by both chemists and farmers. It is on account of this much reduced acid content in sorghum after heading or flowering that practical experience has shown that the crop can be safely fed to cattle after the flowering stage. It is also a matter of general knowledge in America that cases of prussic acid poisoning are much less common in the Gulf States there than in the States farther north, very few complaints regarding sorghum poisoning being received from a latitude south of 35 degrees. This freedom from poisoning is particularly observed where the climate is hot and moist, and while total disregard of caution in the feeding of sorghum is, of course, not advocated in any circumstance, it may be stated that there seems to be a climatic relation between the prussic acid content of the plants in New South Wales, also. Dairy-farmers on the far North Coast generally have had less trouble with sorghum poisoning in cattle than farmers on the tablelands, western slopes, or even on the South Coast.

Actual chemical analyses are required definitely to establish this climatic relation, and such analyses are necessary also to the investigation of a conclusion recently arrived at by American chemists, namely, that varietal difference is probably of more significance in the determination of the amount of prussic acid in sorghum than are conditions of growth.

American investigators have found that twice the dose of prussic acid accepted as fatal can be given to an animal without causing death if the acid be accompanied by glucose, which, with dextrose and other forms of sugar, is a recognised antidote to the poison. The formation of these sugars from starch in the paunch of an animal possibly explains why cattle fed on corn (maize) or other starchy concentrated food can ordinarily be pastured in a sorghum field without injury.

It may be of interest to close this review of the subject by quoting the treatment recommended by the veterinary officers of the Stock Branch of this State for animals poisoned by hydrocyanic acid in plants:—

Hypodermic injection of sulphuric ether; dose for ox, 10 c.c.

In default of above the following mixture might be kept handy:—Bottle (1)—An ounce of carbonate of soda in a pint of water, kept tightly corked. Bottle (2)—Half an ounce of sulphate of iron in a pint of water. Mix the two lots, and give to the animal immediately after mixing. Dose for cow, 1 quart; for sheep, 1 pint.

Stimulants, such as hypodermic injections of strychnine and large doses of such drugs as nitrous ether and ammonium carbonate, may be of some value.

Cottage Landscape Gardening.

[Continued from page 65.]

E. N. WARD, Superintendent, Botanic Gardens.

THE two designs of front gardens in this article are intended to represent the two extremes of aspect. Style C faces the north-east, with little protection from the midday sun or shelter from hot and drying westerlies. The other style, D, is just the opposite, facing south-east, with a slope to the south-west—an aspect that is nearly always cold, damp, or shady, and unsuitable for many kinds of plants.

It is surprising, however, what delightful effects can be obtained in these two gardens if the ground is properly prepared, and the right subjects are chosen.

Style C.

The designs are recommended for any aspect. The front entrance of style C is at the north-east corner. If it should be necessary to have this gate at the north-west corner, the plan may be held up to the light back to front, and the lay-out for the reverse position is obtained. The purpose is to give suitable planting schemes for both aspects.

For the hot and dry garden, our native flora is recommended, making the garden into a real Australian one. The squared design, Nos. 1 to 5, could now be bright with Australian annuals, which for beauty and colour massing cannot be equalled by any set of introduced annuals. Strange to say, it is in Europe that these are most appreciated, and it is from there the best seed is to be obtained.

In bed No. 1 sow or plant from box-grown seedlings, the pink and white Rhodanthe—one of the pretty Western Australian everlastings usually sown in spring, showy in the garden and useful for cuttings.

In No. 2, sow the Swan River Daisy, catalogued as *Brachycome iberidifolia*. This delightful annual could be styled a minature cineraria; its star-like flowers have a big range of colours and its foliage is light and graceful. This also should be sown in spring where it has to flower.

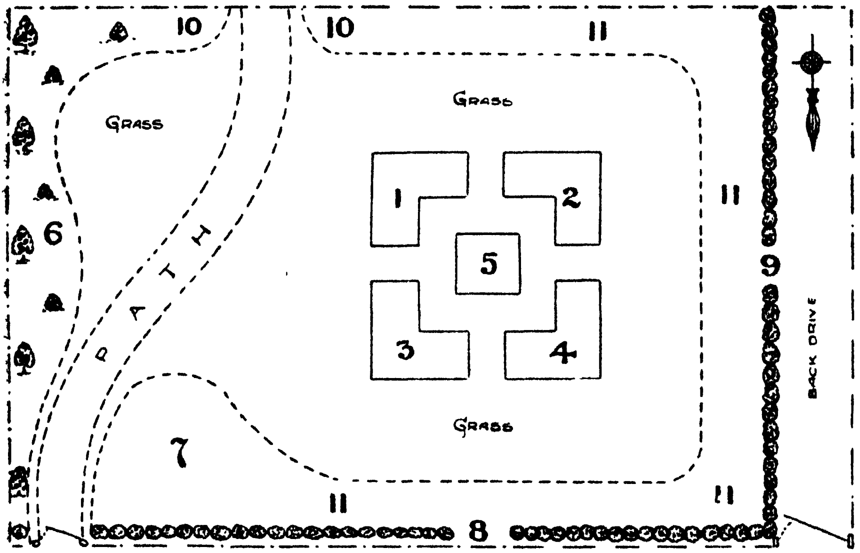
No. 3 would look well planted or sown with a native of this State—*Isotoma axillaris*, a free-flowering, Campanular-like, white to pale lavender flower, lasting from late spring to early autumn.

In bed No. 4, sow or plant from nursery-grown seedlings another of the western composites, called *Acroclinium roseum*, a plant similar in habit and appearance to Rhodanthe. All these are easily grown.

In the centre of bed No. 5, plant a native pine, choosing from *Callitris robusta* or its graceful and deep green variety *verrucosa*, *cupressiformis*, *Muelleri*, and *Macleayana*. These are sometimes catalogued under the name of Frenela. In warm sheltered coastal districts the Cabbage and

Bangalow palms would be effective, while for a specimen shrub the beautiful spring-foliaged and autumn-berried *Eugenia Luchmanni* stand alone in any such bed or on a lawn. Round this specimen, whatever it is, plant about eight Swainsonas or Chorizema.

On the western side marked 6, plant nine small trees or tall shrubs. A good nine would be:—*Grevillea Banks,* var. *Forsteri* (an ornamental foliaged plant with bright red flowers), *Pittosporum rhombifolium* (well worth a place for its showy bunches of bright-coloured berries), *Hymenosporum flavum* (one of our most profuse yellow-flowering trees), *Backhousia citriadora* (an upright-growing shrub, the leaves of which are similarly and quite as strongly scented as the lemon-scented verbena), *Hibiscus splendens* (a pyramidal, tall shrub, with pink flowers), *Callistemon salignas* (a tree bottle-brush), *Panax elegan* (a graceful foliaged tree), *Eugenia Smithii* (the Lilipili), and *Stenocarpus sinuatus* (the wheel tree).



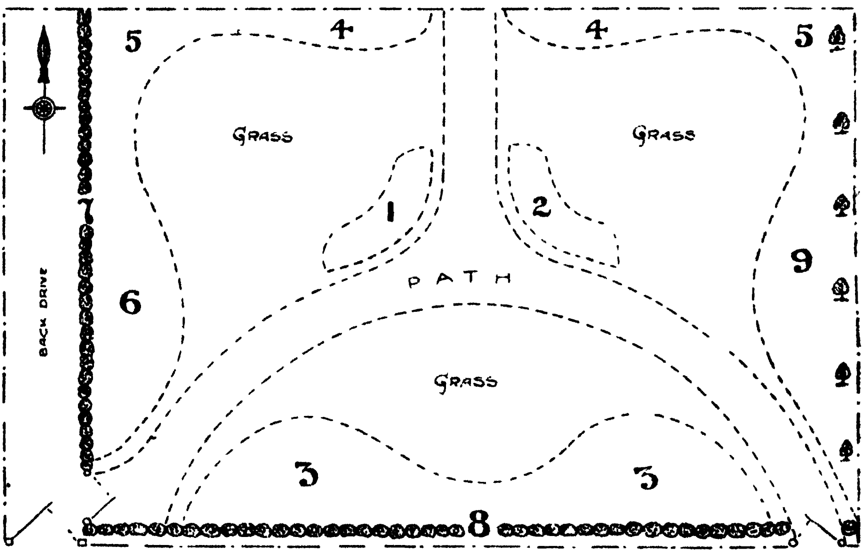
Style C.

In the border at 7, plant five or six scarlet-flowering gums, with the same number of Christmas bushes as undergrowth.

As a hedge at No. 8, plant our native jasmine (*Jasminum simplicifolium*), and at No. 9 *Melaleuca armillaris;* this makes an excellent hedge if it is not allowed to grow too strongly before being clipped, which causes it to become thin at the bottom.

At 10, if the verandah is well elevated, plant the Geraldton wax-plant, *Chamaelaucium uncinatum.* This western plant commences to flower in July, and is still carrying its coloured sepals in November. If the elevation is not quite so great, plant a pair of the common bottle-brush (*Callistemon lanceolata*), while if the verandah is almost level with the ground the Australian rosemary (***Westringia rosmarinaefolia***) may be used instead.

Round the border marked 11 plant a choice collection of native shrubs, flowering and ornamental, selected from the following list—the first-half are tall-growing and should be planted at the back, and the remainder are low-growing, and may be either grown singly or in groups:—***Callistemon acuminata, Leptospermum lanigerum, Acacias lunata*** and ***pulchella, Cassia Brewsteri*** (one of the most gorgeous of our flowering legumes which, even if it refuses to flower under cultivation, as it does sometimes, is still worth growing for its foliage), ***Jacksonia scoparia*** (which flowers just as profusely as the European brooms), the Illawarra Blue Berry (***Elaeocarpus cyaneus***), ***Doryanthes Paleri*** or ***excelsa, Crinum pedunculatum*** (for foliage), the variegated form of the Port Jackson Fig, the belar or "bull oak" (***Casuarina glauca***), and the Queensland Nut (***Macadamia ternifolia***). These can all be kept within bounds and make a good background to groups of ***Cassia artemesioides*** (a small plant that never fails to produce a profusion of yellow flowers, and even when it overdoes itself it is always generous in the seed it leaves behind it carry on its species), ***Clianthus Dampieri*** (sown where it has to flower), different varieties of Swainsona and of Chorizema. ***Boronias megastigma***, our "native rose" ***Serrulata***, ***Hardenbergia Comptoniana*** (from Western Australia, and the ***Monophylla*** of our State), on a stump or rock the "rock lily" (***Dendrobium speciosum***), at the corners where there is most room ***Grevillea puniasa*** and ***Lambertia formosa***, the native fuchsia (***Correa speciosa***), with here and there a Burrawang (***Macrozamia spiralis***).



Style D.

There are many others that one is tempted to add to this list, but only those that are obtainable from nurserymen have been recommended.

How to Grow Native Plants.

It is a mistake to think that our native plants do not like rich soil. They do, but, with very few exceptions they dislike raw and fresh manure. What the majority of our bush plants do not like is root interference. They should be grown in a place to themselves, in a garden like style C, not in the mixed borders where once a year at least other plants are being dealt with and the soil renovated. They should be allowed to grow thickly so that there is no room for anything, no room to dig, even if you wanted to. There is no reason why the bright Lambertia should not cuddle itself under and round the stem of a bottle-brush, and if a Jacksonia should poke itself out of the top of the same bottle-brush no harm is done; they love to snuggle up to each other. When you have grown your first line of defence, or a base for others to jump off from, there is a wide range of possibilities. In fact so much at home could you make your native plants in your native plant garden that not only the bright flowering gems from Western Australia, but many of our native ferns, could be made to grow.

Successful and permanent development is best attained by seedlings grown by yourself. Transplanting from the bush has its merits, but they are limited. Much can be done by purchase, but there is not the same pleasure in growing a plant some one else has raised as the one you can claim as your own.

Style D.

This calls for quite a different class of plant, but none the less beautiful. The main essential for success is to see that on such an aspect the drainage is right. The planter should also refrain from planting anything that will grow too tall and cast shadows.

There are many ways of planting such a garden. The following recommendations are meant for the Sydney district and all places with a similar climate; a few alterations would have to be made where frosts are continuous.

In beds Nos. 1 and 2, plant the dwarf Begonia semper florens, the best varieties of which are Firebrand and Prima Donna. Planted about the end of October, these will keep in flower till late autumn, when they might be replaced with primrose and polyanthea or with cinerarias.

The whole of border No. 3 should be devoted to azaleas, with an edging of violets, var. Princess of Wales. These azaleas should be carefully chosen in three sections—early, medium, and late. The back should be planted with tall-growing and free-flowering singles, such as Splendens, Stella, Magnifica, and Indica alba. A middle row should consist of medium growers, such as Comtesse de Flanders, Flag of Truce, and Colaris Nova; while in the front, twice as thick, plant the dwarfer-growing hybrids with double and large single flowers in numerous shades, such as Charles de Back, Roi de Hollande, Deutsche Perle, Splendide, Cocarde Orange, Amoena and its varieties, Duc de Nassau, Magnet, and Marquis of Lorne.

The border marked 4, in front of the house, would always look fresh and furnished if planted with the common Fish-bone fern, relieved in a few place with strelitzia, Aspidistra lurida, and Moraea bicolor.

In the corners marked 5, plant tree ferns (*Alsophylla Cooperia*).

Border No. 6 should be planted with tree begonia. At the back plant Corallina (and its white variety if you can purchase it), Carnea (and its variety Odorata), the free-flowering Silver Spots, Undulata (the parent of most of them), Smithii, Lucerna, and President Carnot. In the front, Beatrice and Mabel Roseby, Indian Princess, Taliana, Ingraini, and Fuchsiodes may be used. Until these are fully grown the common semper florens type might be used to clothe the ground.

At No. 8, a cypress hedge would be appropriate—in cold districts *Cupressus torulosa* or *macrocarpa*, and in warm or coastal districts *Cupressus sempervirens* or *Juniperus virginiana*. These may be clipped as low as 4 feet or up to 12 feet high. Plant No. 7 with either hibiscus, George Harwood, Gardenia globron, or a hedge of Begonia Silver Spots.

On the border No. 9, plant a collection of hydrangeas; there are some very fine varieties now offered by nurserymen. In the back row plant Hortensia, Otaksa, Japonica, Ajisai Madame Moulliere, Madame Renee Gaillard, Mariesii, and its two varieties Lilacina and Grandiflora. In the front row plant the dwarfer-growing varieties Mont Rose, Variegata, La Lorraine, Dentello, Innocence, Jeane D'Arc, Avalanche, and Sono de Madame Chaland. At the back, near the fence, plant a few bamboos, but not of the suckering type.

Make the lawn with buffalo grass; this will not die out in a shady place so quickly as couch grass.

(*To be continued.*)

AMERICAN STOCK-BREEDERS DECLARE AGAINST THE SCRUB.

THE "Better Sires—Better Stock" campaign, inaugurated by the United States Department of Agriculture in the autumn of 1919, to stimulate the replacement of low-class breeding animals with pure-bred sires and improved females, has gone ahead with increased impetus in recent months, in spite of depression in the farming and live-stock business. During the last quarter, ending 30th September, 894 persons were enrolled as having done away with all scrub and grade or crossbred sires, and having determined to use only pure-bred sires henceforth for all classes of stock raised. This shows a promising increase over the two preceding quarters, in which 714 and 333 persons, respectively, were enrolled. There was a corresponding gain in both animals and poultry reported by these owners, the combined total for the three months reaching 108,906.—U.S. *Weekly News Letter.*

CAN the peaks and valleys in prices, which are injurious alike to consumer and producer, be reduced by more efficient marketing methods? On the solution of this problem depends the future of American agriculture.—H. L. RUSSELL.

Pure Seed.

GROWERS RECOMMENDED BY THE DEPARTMENT.

THE Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Wheat:—

Bomen	Manager, Wagga Experiment Farm, Bomen.
	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
	Manager, Experiment Farm, Temora.
	A. A. Wilson, Kyeema, Old Junee.
	J. W. Eade, Eade Vale, Euchareena.
Canberra..	Manager, Wagga Experiment Farm, Bomen.
	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
	W. W. Watson, Woodbine, Tichborne.
	J. W. Eade, Eade Vale, Euchareena.
	Hughston Bros., Marsden-street, Boorowa.
Cleveland	Manager, Experiment Farm, Bathurst.
	J. W. Eade, Eade Vale, Euchareena.
College Purple	Manager, Experiment Farm, Temora.
	Hughston Bros., Marsden-street, Boorowa.
Comeback	Manager, Experiment Farm, Temora.
Currawa	Manager, Experiment Farm, Temora.
	Hughston Bros., Marsden-street, Boorowa.
	J. W. Eade, Eade Vale, Euchareena.
	T. J. A. Fitzpatrick, Erin Vale, Warre Warral
Federation	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Trangie.
	Manager, Experiment Farm, Temora.
	A. A. Wilson, Kyeema, Old Junee.
	W. W. Watson, Woodbine, Tichborne.
Firbank	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Trangie.
	J. W. Eade, Eade Vale, Euchareena.
	Harvey Bros., Enterprise, Dubbo.
Florence...	Manager, Experiment Farm, Trangie.
	Manager, Experiment Farm, Coonamble.
	Manager, Experiment Farm, Glen Innes.
Gresley	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	E. T. Walker, Wattamondara.
	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
	Gollasch Bros., Milbrulong.
Hard Federation	Manager, Experiment Farm, Bathurst.
	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
	Manager, Experiment Farm, Temora.
	J. W. Eade, Eade Vale, Euchareena.
Improved Steinwedel	Manager, Experiment Farm, Bathurst.
	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
	Manager, Experiment Farm, Trangie.
	Manager, Experiment Farm, Temora.
Major	Manager, Experiment Farm, Temora.
	Manager, Wagga Experiment Farm, Bomen.
	W. W. Watson, Woodbine, Tichborne.
	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
Marquis	Manager, Experiment Farm, Glen Innes.
Marshall's No. 3	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.

PURE SEED—*continued.*

Wheat—continued.	
Penny	Manager, Experiment Farm, Temora.
	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
	W. W. Watson, Woodbine, Tichborne.
	E. J. Allen, Gregra.
Sunset	Manager, Experiment Farm, Coonamble.
Tarvey	W. W. Watson, Woodbine, Tichborne.
Waratah	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Temora.
Warden	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	J. W. Eade, Eade Vale, Euchareena.
	W. W. Watson, Woodbine, Tichborne.
	Gollasch Bros., Milbrulong.
	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
Warren	Manager, Experiment Farm, Trangie.
Yandilla King	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	A. A. Wilson, Kyeema, Old Junee.
	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
Zealand	Manager, Experiment Farm, Temora.
	J W. Eade, Eade Vale, Euchareena.
***Oats*:—**	
Algerian	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
Guyra	Manager, Experiment Farm, Temora.
Lachlan	Manager, Experiment Farm, Cowra.
Ruakura...	Manager, Experiment Farm, Temora.
Sunrise	Manager, Experiment Farm, Trangie.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Coonamble
	Manager, Experiment Farm, Cowra.
	N. S. Meek, Hobby's Yard.
***Barley*:—**	
Kinver	Manager, Experiment Farm, Temora.
Trabut	Manager, Experiment Farm, Cowra.
Cape	Manager, Experiment Farm, Temora.
***Clovers*:—**	
Shearman's Clover (roots) ...	J. H. Shearman, Fullerton Cove, Stockton.
Kikuyu Grass:—	Principal, H. A. College, Richmond.
	Manager, Wollongbar Experiment Farm, Lismore.
	Manager, Experiment Farm, Grafton.
Elephant Grass:—	Principal, H. A. College, Richmond.
	Manager, Wollongbar Experiment Farm. Lismore.
	Manager, Experiment Farm, Grafton.

In addition to those tabulated a number of crops were inspected and passed, but as the growers failed to forward samples their seed has not been listed.

CORRECTION.

AN error occurred last month in transcribing portion of a report of the potato plots on the farmers' experiment plots in the New England district. In the first paragraph below the tables on page 29 of the *Agricultural Gazette* will be found the statement "P7 mixture generally gave satisfactory results in these trials." This should have read "P9," as, indeed, the tables plainly show. P9 consists of 10 parts superphosphate, 3 parts chloride of potash, and 3 parts sulphate of ammonia.

Poultry Notes.

FEBRUARY.

JAMES HADLINGTON, Poultry Expert.

OWING to the approach of the moulting season and the hens finishing their second season's laying there will, from now on, be a sharp falling off in egg-production, and this notwithstanding the fact that many of the early pullets from last hatching season will have begun to lay.

Leaving out the assistance from pullets, the expectations on a 12-dozen basis will be 11 eggs per hen for this month. Reference to the table of expectations for laying set out in these notes in November last will show that a marked falling off is anticipated. If this is so on a 12-dozen basis, what is to be expected where a much lower average is being obtained? It is chiefly from now on till August that the loss in egg-production is sustained, which results in low general averages. As was pointed out in November, almost any hen will lay in the season of plenty; it is at the present season of the year that the "stayers" (the hens that do not moult until later) are in evidence. Hens that are in moult now are usually poor producers, and once they cease laying but little can be expected from them for some months to come.

The poultry-farmer's hope for egg-production from now on till July or August is therefore centred in his pullets of last season's hatching. If a good number of June, July, and August-hatched pullets are in evidence, and if they have been well reared, properly housed and cared for, they will materially assist in maintaining the income from egg-production over the slack months as compared with the flush season, and will only quite maintain the total where there is an excess of pullets reared over the number of old hens to be marketed. A normally-stocked farm carrying say, 600 layers, would at this time of the year consist of 300 pullets, 300 first-year hens, and 300 old hens finishing their second year's laying. Indeed, the last 300 are probably already in the process of being marketed as they go off, and it is to replace them that the 300 pullets have been raised. The average laying of the first-year hens will drop as low as four eggs per hen, even where the 12-dozen average is being obtained, and perhaps to zero where it is not.

Look to the Pullets.

Here again might be repeated the advice tendered quite recently in these notes: Don't crowd too many pullets in one house, or make changes in their food. If changes are absolutely necessary, they should be made very gradually, or the result may be disastrous to egg-production. Many thousands of pullets are upset in this way, and fail to do any good again until the spring. Pullets must be in good hands to keep them laying during the autumn and winter months.

Market the Old Hens.

Special attention to the laying stock will now be necessary to avoid loss through carrying too long hens that should be marketed right away. These will consist, for the most part, of the hens that have finished their second season of laying, that is to say, hens that are 27 to 30 months old.

Some farmers are keen enough in getting away their old hens as they go off laying, but there are only too many who persist in carrying many of this sort much too far into the autumn and even into the winter months, in the vain hope that they will finish moulting early and come on to lay again. Many farms fail to pay from this cause alone.

It, of course, does not follow that all hens of the ages mentioned have ceased to lay, or will do so immediately, and age alone must therefore not be the determining factor in their disposal, but as birds of these ages cease to lay, and show signs of going into moult, they should be marketed as soon as possible to get them off the food. As a rule early moulters are disappointing as layers.

It is not difficult to pick out the nonproducers even without handling most of them. When once the comb shrivels up or turns dark and limp, the hen may be suspected of having ceased to lay for the time being. If further confirmation of the fact is necessary, let the farmer examine the state of the pelvic bones. If they are found to be close and rigid, or approaching that stage, there is no risk of loss of eggs in marketing them. This test should not, however, be applied to pullets coming on to lay, except for the purpose of ascertaining that fact, because, if employed for the purpose of culling, prospective good laying pullets might be sent to market.

It was shown in these notes some time ago that the pelvic-bone-theory of testing hens or pullets for laying capacity has been much over-rated and especially that testing before they commence to lay is foolish. But when used for the purpose mentioned in the previous paragraph—that is, to decide the issue as to whether or not a hen is actually laying—it is of real value. It enables the poultry farmer to go into his poultry houses at night while the birds are at roost, and if he wishes to do so, to cull out his crate of nonlayers for market, and he can do so with very little fear of making a mistake.

It is right here that the poultry-farmer without a full knowledge of the subject will do well to leave the measurement tests for other purposes and, for that matter, pelvic bone formation also.

Distinguishing Different Ages.

It is possible for any poultry-farmer to have his hens so marked with a band or toe punch that he is able to distinguish the different ages of the hens on the farm at sight. Unfortunately, many farmers have not systematised their work in a way that will enable this to be done. The consequence is that when this season of the year is reached, it is more or less guesswork as to which hens are finishing their first and which their second year's laying. The result is that many of the fresh-looking old hens are adjudged to be first year, and others of the younger hens, who happen at the time to be temporarily out of condition, are culled and marketed as old hens. Such mistakes cost the farmer dearly, for, whereas the average hen finishing her first year's laying will return a good profit over her keep in the ensuing twelve months, the average second-year bird (coming third) will show a loss. This means that the loss is twofold. When we get this feature into proper perspective, it is not difficult to see the loss that can occur from this one item owing to lack of system.

How to Systematise this Work.

Many farmers, while making an attempt to keep their different ages separate, fail, owing to the birds getting mixed more or less. If this has happened previous to, or during the latter part of the year, it is well nigh impossible to distinguish the ages except to class them as young or very old. Keeping the different ages apart by yarding should not be relied upon, and leg banding should take its place. I say leg banding advisedly, because, relying upon the punched toe means handling every bird whenever it is necessary to distinguish the ages, which is no light task, whereas, if leg bands are properly used the birds can be distinguished at sight without risk of mistake. The bands should be used in such a way as not to conflict with pedigree markings.

Different Classes of Bands.

At the present time there is no scarcity of suitable and distinguishing leg bands for this work. There are celluloid bands in a variety of colours, and metal bands with or without numerals, but there is perhaps no more simple and effective band that can be used for this purpose than those made from simple copper wire, which the farmer can make himself. The way to make these bands is to purchase a quantity of No. 12 copper wire, wind a portion round a wooden peg (the size of the legs required), keep the wire wound very closely together, take it off the peg and cut the spiral column thus made up the centre; the whole will then fall into suitable bands. They are twisted to put on the leg and the ends closed. Any class of band can be used, of course, but the copper wire bands are inexpensive, and can be put on one leg to denote one year, and on the other leg to denote the other year. If the birds are banded sufficiently early each year, while it is still easy to distinguish hens from pullets, then only one band is necessary, and that for the hens intended to be marketed the following year. If there is a carry-over of hens into their third year, the banding of different legs will be necessary. Now is the time to leg-band the hens that are to be marketed in 1923.

Apart altogether from the marketing side of the matter, the advantages to be derived from such a system will much more than compensate for the labour involved.

When looking over the stock on a farm for the purpose of estimating the possibilities in egg-production, with a view to summing up the position and prospects, and determining whether or not production is up to reasonable expectations, one is often put quite out of the reckoning owing to the fact of first and second-year hens being mixed in the different enclosures. The farmer will aver how difficult it is to keep these ages separate. "They will get mixed, somehow," is the usual dictum, but that would not matter if the hens were marked. The simple system advocated above would obviate all difficulty, save the farmer endless trouble, and enable him to market exactly what he wished to do, instead of (as is often the case) keeping numbers of third-year hens, lest some of the younger ones should be marketed.

Hens in their Second Year.

Here again a word of advice seems necessary. There are numbers of hens that are only finishing their first year of laying, but which are no better than many that are finishing their second. The number of these will be much in proportion to the rearing, whether good or bad, afforded the birds in the first few months of chickenhood. There are thousands of poor, weedy specimens carried over every year that have no possible chance of returning a profit to their owner. Here, then, is where the skill, judgment, and power of observation of the poultry farmer is put to the test. When we get down to average production, constitution plays an even greater part in egg-production than hereditary traits. It is a matter of common knowledge that many potentially high-laying hens fail badly in the second year, simply because they lack the necessary constitution to back up hereditary tendencies. This is one of the reasons why birds hatched late or out of season should be subjected to close scrutiny when they are finishing their first year's laying.

Monthly Expectations.

Reverting to the monthly expectations of laying as published in November issue, I have been requested to state whether these averages applied to first or second-year hens. It might be stated that for the purpose of these averages, half first and half second-year birds are taken. This is the normal condition of an average poultry farm working on an even basis.

Prevention of Chicken Pox.

An ambiguity occurred in these notes last month, in connection with the use of flowers of sulphur for the treatment of chicken-pox or warts in poultry. The sulphur to be administered in the morning mash should be given, not every day for the period of three weeks, but two or three times a week only for the three-week periods—as a matter of fact, every third morning is about right. The weight of the mash should be taken as dry matter, not as wet. This disease is also dealt with on pages 126 and 127 of "Poultry Farming in New South Wales" (third edition).

A HANDSOME poster, illustrating in colours six of the worst weeds of the State, has been prepared with the object of helping farmers and young people in the identification of these common pests. Space is left on the poster for the name of the shire to be printed where quantities are required. Copies are obtainable from the Government Printer, Sydney, at 9d. each.

Orchard Notes.

FEBRUARY.

W. J. ALLEN and S. A. HOGG.

Drying Fruit.

IN the inland districts some varieties of peaches will be ripening this month, and where it is not proposed to can any of the freestone varieties drying will have to be resorted to. Care should be taken to see that the fruit is perfectly ripe and free from blemishes. It should be graded before being pitted, and the different sizes of fruit should not be mixed on the same tray. Having removed the pits, the halves should be subjected to sulphur fumes, using approximately one pound of sulphur to every 300 cubic feet of space. The sulphur may be burnt inside the fumigating house, but care should be taken not to place the sulphur pots immediately under the fruit, but at some distance, so that the fumes may rise and be evenly distributed. The time required for fumigating varies according to the variety of peach being treated, but generally speaking about eight hours is sufficient. Where it is thought advisable to dry pears, it should be borne in mind that heavy fumigation is necessary to produce a nice bright colour; a period of twelve to twenty-four hours is necessary.

Prunes will also be ready for processing in some districts. It is very advisable that the fruit should contain the maximum amount of sugar before being handled. The first crop of prunes may be allowed to drop from the tree, and should be collected from time to time in order to prevent the fruit from becoming scalded by the sun. If arrangements could be made, it would be preferable to grade the fresh fruit before dipping. The second ripening of the prune crop may be gathered by placing sheets underneath the trees and gently shaking the branches. Care should be taken only to remove the ripe fruit. The last picking of prunes has generally to be done by hand, as a lot of the fruit will toughen up and remain on the trees. In dipping prunes in the boiling caustic solution, great care should be taken to see that the solution is not too strong, but only of a strength sufficient to remove the natural wax that is on the outside of the fruit and to slightly mark the skin without cracking into the flesh.

Where Zante currants are grown it should be borne in mind that the ultimate quality is also governed by the sugar content, and care should be taken not to pick the fruit until it is perfectly ripe. These grapes may be immediately placed on hessian, wooden trays, or wire racks, and should be dried in the shade. Sultanas may be ready to dry this month or early next. If a bright, heavy sample be desired, these also must be dead ripe before being picked. The fruit should be dipped in a caustic solution that has been brought to the boil, but allowed to cool to within a few degrees of boiling point before dipping The strength of this solution can only be accurately gauged by examining the bunches from time to time, and noting whether the berries are only just cracked or are splitting. If the solution is of the correct strength, only the base of the berries should show a few minute cracks. It seems optional whether the fruit should be redipped in cold water or placed immediately or the trays. Either method gives good results providing the dip is correct in the first place.

If the weather is at all dull, the grapes may be exposed to the light, but if the sun is bright it is better to continue the drying in the shade. Of course they will dry in the shade at any time, providing the atmosphere is not moist, but it takes considerably longer than when exposed to a dull heat. The same instructions apply to raisin grapes, but being larger than either sultanas or currants, it will be found necessary to expose them to the sun for a short time while drying, although they may be dried in racks if time be no object.

Fumigation.

While this is considered one of the best months for carrying out fumigation, under no circumstance should it be done if the trees are out of condition through lack of moisture in the soil. A tree suffering from drought or want of cultivation, can easily be damaged by either spraying or fumigating.

Fumigation should be carried out at night, or during the cool part of the day, always avoiding hot days. During past years we have carried out fumigation work in March and April so as to avoid the hot weather of February. This seemed to have been satisfactory, and the scale has been killed and the trees kept free from damage.

Summer Training of Young Trees.

Where trees are being grown under irrigation it may be found necessary, especially in the case of young trees (and particularly peaches), to go through them a second time and thin out the centres so as to allow thorough circulation of air and light for the purpose of ripening up and maturing the main branches for the ensuing season.

If the bearing trees should be showing any signs of distress through lack of moisture, it would be advisable to give them an irrigation. On the other hand, if they have received an ample supply during their growing period this, of course, will not be necessary.

With regard to young citrus trees, care should be taken to protect the trunks of the young trees from the sun, until such time as the branches lend natural protection. In some cases old bagging is used for this purpose, bnt it has some slight objections, the chief one being that white ants are rather apt to get between the bagging and the trunk of the tree, and if there happens to be a dry patch on the trunk, the ants will enter it, and if not detected will eventually destroy the tree.

If young citrus trees be suffering from the attacks of scale, they may be sprayed at this time of year with a fair degree of safety, that is to say, without damaging the foliage to any material extent. Miscible oil or resin and soda may be used according to the nature of the pest. Either of the sprays mentioned is very effective against red and brown scale. In the drier areas where irrigation is not available, it is considered advisable to have the orchard ploughed as soon as the fruit has been removed, with a view to conserving the winter rains. It will not matter at this time of year if the land turns up in lumps; in fact it is rather an advantage in checking flood waters and absorbing the rain.

Cover crops.

Where irrigation is available cover crops may be used as a means of supplying the soil with humus. A heavy sowing of either peas or rape may be made, providing the crops are kept well supplied with water throughout the winter, and ploughed in early in the spring so as to allow them to become well rotted and incorporated with the soil before summer cultivation takes place.

TO TRANSFER BEES FROM OLD HIVES TO NEW.

So unsystematically do some people commence bee-keeping that by the time they have decided that it is an occupation worthy of serious application, their stock is housed in hives of all shapes and sizes. Bee-keeping, on even the most modest scale, should be commenced with good hives of modern standard type. The transfer of bees from old hives to those of standard pattern may be effected as follows:—

For each hiveful of bees to be transferred, prepare a standard hive body, complete with frames, and standard-sized bottom board. All the frames, with the exception of one in each body, should be wired, and contain sheets (preferably full ones) of comb foundation. Find and cage the queen from the old hive, cut out a selected comb of brood from one of the frames, and fit it neatly into the unwired frame from one of the new bodies, making it secure with string fastened right round the frame, and place the frame of brood in the new body toward the centre. Remove the old body from its stand, and substitute the new hive body with its bottom board, but no cover. Place a queen excluder over the new body, fit over this the old hive, minus its bottom board, and finally liberate the queen at the entrance to the new hive.

The object of the foregoing procedure is to get the queen established in the body of the new hive, and to allow the brood in the old hive to emerge and keep up the strength of the colony. The queen will, of course, be unable to re-enter the old hive because of the excluder. Nine days after the tranference, the old hive on top of the excluder should be examined, and any queen cells destroyed. In twenty-one days all the brood in the old hive will have emerged, and the apiarist can remove the excluder and the old hive and replace them with standard supers.

Transferring work should be carried out during warm weather while a honey flow is on, and preferably during the early summer, but if the autumn prospects for bees are good, early February is not too late.—W. A. GOODACRE, Senior Apiary Inspector.

AGRICULTURAL SOCIETIES' SHOWS.

SECRETARIES are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1922.

Society.	Secretary.	Date.
Shoalhaven A. and H. Association	H. Rauch	Feb. 8, 9
Fairfield West Progress Association	H. P. Godfrey	,, 9, 10, 11
Central Cumberland A. and H. Assoc. (Castle Hill)	H. A. Best	,, 10, 11
Coramba A. Society	H. E. Hindmarsh	,, 14, 15
Yanco Irrigation Area A. Society	———	,, 14, 15
Southern New England P. and A. Association (Uralla)	H. W. Vincent	,, 14, 15, 16
Ulladulla A. and H. Association (Milton)	R. F. Cork	,, 15, 16
Nepean District A. H. and I. Society (Penrith)	C. H. Fulton	,, 16, 17, 18
Dapto A. and H. Society	J. J. Cook	,, 17, 18
Wyong District A. Association	C. H. Chapman	,, 17, 18
Rydal A. H. and P. Society	S. B. Prior	,, 18
Guyra P. A. and H. Association	P. N. Stevenson	,, 21, 22
Moruya A. and P. Society	H. P. Jeffery	,, 22, 23
Dorrigo and Guy Fawkes A. Association	A. C. Newman	,, 22, 23
Newcastle A. H. and I. Association	E. J. Dann	,, 22 to 25
Robertson A. and H. Society	E. S. Martin	,, 22, 23
Dorrigo and Guy Fawkes A. Association	A. C. Newman	,, 22, 23
Tahmoor Branch of A. Bureau	E. S. Key	,, 24, 25
Berry A. Association	J. A. Chessell	,, 24, 25
Hannamvale Agricultural Bureau	W. Buttsworth	,, 24, 25
Tenterfield A. Society	E. W. Whereat	Feb. 28, Mch. 1, 2
Tumut A. and P. Association	T. E. Wilkinson	March 1, 2
Manning River A. and H. Association	R. N. Stow	,, 1, 2
Bega A. P. and H. Society	H. J. B. Grime	,, 1, 2
Braidwood P. A. and H. Association	R. L. Irwin	,, 1, 2
Bellinger River A. Society	J. F. Reynolds	,, 1, 2
Griffith A. Society	E. A. H. Richards	,, 1, 2
Alstonville A. Society	S. A. Benson	,, 1, 2
Oberon A. P. and H. Association	C. S. Chudleigh	,, 2, 3
Berrima District A. H. and I. Society	W. Holt	,, 2, 3, 4
Blacktown and District A. Society	J. M. McMurtrie	,, 3, 4
Yass P. and A. Association	E. A. Hickey	,, 7, 8
Glen Innes P. and A. Society	Geo. A. Priest	,, 7, 8, 9
Kangaroo Valley A. and H. Association	L. W. Vance	,, 8, 9
Bowraville A. Society	H. C. Newnham	,, 9, 10
Taralga P. and H. Association	J. J. Kearney	,, 9, 10
Hastings P. A. and H. Society (Wauchope)	A. D. Suters	,, 9, 10
Campbelltown A. Society	J. T. Deane	,, 10, 11
Gundagai P. and A. Society	A. J. Fuller	,, 14, 15
Mudgee A. P. H. and I. Association	S. H. Somerville	,, 14, 15, 16
Armidale and New England P. A. and H. Assocn.	A. H. McArthur	,, 14 to 17
Cumnock A. Society	K. J. Abernethy	,, 15
Cobargo A. P. and H. Society	T. McKennelly	,, 15, 16
Crookwell A. P. and H. Society	C. H. Levy	,, 15, 16
Bangalow A. and I. Society	W. H. Reading	,, 15, 16
Barraba P. A. and H. Association	C. E. Williams	,, 15, 16, 17
Wallamba District A. and H. Association (Nabiac)	G. H. O'Connor	,, 16, 17
Luddenham A. and H. Association	L. W. Eaton	,, 17, 18
Coonabarabran P. and A. Association	G. B McEwen	,, 21, 22
Batlow A. Society	C. S. Gregory	,, 21, 22
Tamworth P. and A. Association	F. G. Callaghan	,, 21, 22, 23
Nambucca A. and H. Association	M. Wallace	,, 22, 23
Gulgong A. and P. Association	D. H. Spring	,, 22, 23
Hunter River A. and H. Association (Maitland)	J. S. Hoskins	,, 22 to 25
Bulladelah A. H. and I. Society	J. B. Watson	,, 23, 24
Camden A. H. and I. Society	C. C. Irving	,, 23, 24, 25

AGRICULTURAL SOCIETIES' SHOWS—*continued.*

1922.

Society.	Secretary.	Date.
Goulburn A. P. and H. Society	F. D. Hay	Mar. 23, 24, 25
Richmond River A. H. and P. Society (Casino)	P. M. Swanson	,, 29, 30
Macleay A., H., and I. Association (Kempsey)	R. T. Tarrant	,, 29, 30, 31
Upper Hunter P. and A. Association (Muswellbrook)	R. C Sawkins	April 5, 6
Cooma P. and A. Association	C. J. Walmsley	,, 5, 6
Royal Agricultural Society of N.S.W.	H M. Somer	,, 10 to 19
East Dorrigo A. Association	T. B. Timms	,, 15, 17
Orange A. and P. Association	G. L. Williams	May 2, 3, 4
Narrabri P. A. and H. Association	E. J. Kimmerley	,, 3, 4
Clarence P. and A. Society (Grafton)	L. C. Lawson	,, 3, 4, 5, 6
Hawkesbury District A. Association (Windsor)	H. S. Johnston	,, 4, 5, 6
Wellington P. A. and H. Society	A. E. Rotton	,, 9, 10
Lower Clarence A. Society (Maclean)	E. D. Munro	,, 10, 11
Dungog A and H. Association	W. H. Green	,, 10, 11, 12
Coonamble P. and A. Association	J. C. Wilson	,, 23, 24
Murrumbidgee P. and A. Association (Wagga)	A F. D White	Aug. 22, 23, 24
Corowa P. A. and H. Society	J. D. Fraser	,, 29, 30
Junee P. A. and I. Association	T. C. Humphreys.	Sept. 5, 6
Cootamundra A. P. H. and I. Association	Wm. A. Sowter	,, 12, 13
Holbrook P. A. and H. Society	Jas. S. Stewart	,, 19, 20
Temora P. A. H. and I. Association	A D. Ness	,, 19, 20, 21
Narrandera P. and A. Association	W. H. Canton	,, 27, 28
Ganmain A. and P. Association	A. R. Lhuede	,, 12, 13

TO KEEP DOWN FLIES.

ONE of the first measures for the keeping down of flies in country districts should be the treating of all stable manure. It is in this material exclusively that the house-fly breeds. Wherever there are neglected stables or horse-yards the house-fly abounds.

Manure may be covered so that flies cannot lay their eggs in it in any number, and the young flies that emerge from such eggs as are deposited will be unable to get away, and will die. Perhaps the ideal way of dealing with manure is to store it in specially designed open bins, raised from the ground, the bottoms consisting of fine wire-netting over bars. When the maggots generated in the material find the heat caused by the fermentation too great for their comfort, they work their way downwards, and eventually fall on to the space below, where they can easily be collected and destroyed.

The treatment of stable manure with a solution of borax for the purpose of destroying fly maggots does not prove satisfactory unless the whole of the heap is treated and every particle wetted. This, of course, spoils the manure to a certain extent, and is too expensive for practical purposes.

For blow-flies, which are often a pest about country houses, a baited trap, consisting of a kerosene tin, the top of which is fitted with a gauze funnel, is very effective. Such a trap should be situated out of doors, but it may be set quite close to the house, so long as it is not in the neighbourhood of doorways. A pamphlet illustrating and describing this type of trap is available free on application to the Department.—W. W. FROGGATT, Government Entomologist.

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Agricultural Gazette of New South Wales.

Farmers' Experiment Plots.

WHEAT AND OAT EXPERIMENTS, 1921.

Western District.

H. BARTLETT, Inspector of Agriculture.

THE farmers who co-operated with the Department in conducting cereal experiments during 1921 were :—

E. J. Allen, Gregra.
S. Reilley, Eurimbla, via Cumnock.
W. W. Watson, "Woodbine," Tichborne.
S. Plowman, "Emu Vale," Parkes.
R. Shelton, "Elm Vale," Nelungaloo.
T. Gibson, "Plevna," Trundle.
J. M. Connor, "Kokum," Ootha.
Bennett and Klintworth, "Corryburl," Narromine.
A. B. Mason, "Hartwood," Narromine.
J. Parslow, Collie Road, Gilgandra.
D. A. Rich, Wellington.
M. F. Dalton, "Duntry-league." Orange.

Cultural Notes.

Grega.—Fairly heavy red loam; previous crop, winter fodders, 1920, manured with 56 lb. superphosphate per acre. ; fallowed, September, 1920, with disc plough ; ploughed, March, 1921 ; spring-tooth cultivated early in May ; harrowed, 7th May ; sown, 7th May with wheat 60 lb. per acre ; oats, 60 lb. per acre ; superphosphate, 56 lb.

Eurimbla.—Fairly heavy red loam ; previous crop, winter fodders, 1920, manured with 56 lb. superphosphate per acre ; fallowed, November, 1920, with mouldboard plough ; harrowed in December ; ploughed in April ; harrowed in May ; sown, 14th May with 50 lb. wheat and 50 lb. superphosphate per acre.

Tichborne.—Fairly free-working red loam ; previous crop, winter fodders, manured with 30lb. superphosphate per acre ; fallowed, September, 1920 ; spring-tooth cultivated, at end of October ; disc cultivated, 23rd March, 1921 ; spring-tooth cultivated, 14th April ; sown, 10th May with 50 lb. wheat and 56 lb. superphosphate per acre.

Parkes.—Red loam ; previous crop, wheat, 1916, no manure ; fallowed in in August, 1920, with mouldboard plough ; disc cultivated in March, 1921, disc cultivated in April ; sown 11th and 12th May with 50 lb. wheat and 40 lb. superphosphate per acre.

Nelungaloo.—Rather heavy red loam to clayey loam, having a retentive subsoil ; previous crop, wheat, 1919, no manure ; fallowed in September, 1920, disc plough ; disc cultivated in February, 1921 ; spring-tooth cultivated at end of April ; sown, 5th May, with 56 lb. wheat, 56 lb. oats, and 45 lb. superphosphate per acre.

Trundle.—Fairly heavy red loam; myall type of country, having a retentive subsoil; previous crop, grass land since 1915; fallowed in September, 1920, with disc plough; disc cultivated in May, 1921; sown, 15th and 16th May, with 43 lb. wheat, 43 lb. oats, and 40 lb. superphosphate per acre.

Ootha.—Red loam; previous crop, wheat, 1920; stubble ploughed in March, 1921, with mouldboard plough; harrowed in April; sown on 10th May, with 45 lb. wheat, 45 lb. oats, and 45 lb. superphosphate per acre. Federation wheat, and all the oat varieties could not be sown till 1st June, 1921, which placed those varieties at a great disadvantage.

Narromine, "Corryburl."—Red loam, free working; previous crop, wheat, 1917, then grazing; fallowed, June, 1920, with disc plough; spring-tooth cultivated, October, 1920; disc cultivated February, 1921; spring-tooth cultivated, April; sown, 19th May, 1921, with 43 lb. wheat and 35 lb. superphosphate per acre.

Narromine, "Hartwood."—Red loam; previous crop, wheat, 1917, then grazing; fallowed in August, 1920, with mouldboard plough; spring-tooth cultivated in March, 1921; spring-tooth cultivated, 18th May; sown, 20th to 23rd May with 43 lb. wheat and 40 lb. superphosphate per acre.

Gilgandra.—Red loam to fairly heavy grey soil; previous crop, winter fodders, 1920, manured with 28 lb. superphosphate per acre; fallowed, September, 1920, with mouldboard plough; spring-tooth cultivated, 6th October; disc cultivated, November; disc cultivated, January, 1921; disc cultivated, April; sown, 2nd and 3rd May with 50 lb. wheat, 50 lb. oats, and 56 lb. superphosphate per acre. Plots fed off during July.

Wellington.—Red loam; previous crop, winter fodders, 1920, manured with 56 lb. superphosphate per acre; fallowed in September, 1920, and worked as required; sown, 3rd July, with 58 lb wheat and 56 lb. superphosphate per acre. Owing to prolonged wet weather at sowing time, the wheats had to be sown when the soil was in poor condition.

Orange.—Red loam to grey clayey loam; previous crop, winter fodders, manured with 56 lb. superphosphate per acre; ploughed with mouldboard 23rd April, 1921; harrowed 24th April; sown, 4th May with 60 lb. wheat, 60 lb oats, and 56 lb. superphosphate per acre.

The Season.

The crops sown prior to the end of May, 1921, on fallowed land, experienced very favourable conditions, and without exception, comparatively clean crops and high yields of plump grain have been the reward, but from the late sown crops on stubble land, indifferent yields have been harvested, not the least of the contributing factors being the fight which the wheat plants had with the black oats and barley grass.

Bountiful rains were recorded during the fallowing period—August, 1920, till April, 1921—and these being stored in the subsoil, provided a valuable insurance of heavy crops. The months of April and May provided ideal conditions for sowing, but with almost incessant light to heavy rainfall during June and early July, farming operations were practically suspended for six weeks, which prevented considerable areas from being sown, and caused many acres to be put in when the soil was considerably out of condition. The moist, cold condition of the soil rather retarded the early growth of the early-sown crops, and in very rare instances was feeding-off necessary. Rather dry conditions prevailed from the middle of August till the end of September. This was ideal for the early-sown crops, but a decided disadvantage to the late crops, which, instead of stooling and making stem growth, were rather forced to spindle and run into head.

A general defect observed in all crops inspected throughout the district, was the imperfectly filled ears, the lower three to six spikelets failing to develop. This was probably due to the dry conditions that continued well into October, when all crops would have benefitted by a substantial rainfall about the time they were coming into ear. About the end of October, the early crops on fallow were strong, healthy, and quite capable of maturing a satisfactory sample of grain, while the early crops on stubble were showing signs of wilting, and appeared to be drying off instead of ripening. This is the time when fallowed land will "stick to the crop," and when a little reserve of moisture in the soil may make a difference of three to four bags per acre. However, thunderstoms about the end of October, yielding something like half an inch of rain, considerably relieved the situation, and the fears of pinched grain were in most cases dispelled.

Ideal conditions were general throughout the harvest. The hay was all of good colour, and was in the stack before stripping commenced. All the grain was bright, and most of it plump, and of good bushel weight. Never has such a satisfactory harvest in the western district been taken oft more rapidly.

Keep the Fallows Clean.

The fallowing period was rather a strenuous time for the farmer owing to the vigorous growth of weeds, and it is interesting to note the relation between this growth of weeds and the climatic conditions prevailing during the past three years. During the drought period stock were fed with anything edible—imported fodder, perhaps, containing black oats and weed-seeds. They were grazed on weeds, pasture paddocks, and cultivation paddocks, dropping seeds wherever they went. The drought broke during June and July, 1920, and crops were sown, and weeds, black oats, and barley grass grew with the crops, in many cases doing little damage, but, nevertheless, seeding prior to harvest. The ploughing during July and August, 1921, distributed the seed throughout the surface soil, and the seed near the surface germinated when conditions were favourable. Each cultivation given to destroy the weeds brought another supply of soed to the surface, which germinated after the succeeding rains. As the rains were frequent, conditions were ideal for repairing the damage indirectly caused by the drought. The weed-seeds which are in the soil can only be destroyed after germination, and it is far better to do the job in one year than to have dirty crops for a number of years. Those who were able to keep their fallows clean have not only reaped the benefit during the past season in having clean crops, but their work during the successive fallowing will be considerably lightened.

RAINFALL during Fallow Period

—	Tichborne.	Gregra.	Trundle.	Ootha.	Gilgandra.	Narromine.
1920.	Points.	Points.	Points.	Points.	Points.	Points.
August ...	235	330	117	187	156	178
September...	229	285	341	240	252	441
October ...	141	183	81	116	182	126
November ..	168	432	172	165	82	Nil.
December ...	339	550	260	336	454	451
1921.						
January ...	186	110	220	129	143	15
February ...	26	134	32	201	Nil.	29
March ...	165	170	126	155	232	254
April ...	272	265	200	214	648	330
Total ...	1,761	2,459	1,549	1,743	2,149	1,824

RAINFALL during Growing Period.

May ...	272	307	275	184	327	260
June ...	253	217	535	221	308	400
July ...	154	198	25	68	175	161
August ...	163	210	140	111	143	160
September...	135	152	70	124	147	120
October ...	49	138	76	62	132	111
Total ...	1,026	1,222	1,121	770	1,232	1,212

RESULTS of Variety Trials.

Variety.	Trundle.		Nelungaloo.		Tichborne.		Parkes.		Gregra.		Ootha.		Narromine (Corryburl.)		Narromine (Hartwood.)		Gilgandra.		Eurimbla.	
	b.	lb.	b.	lb.	b.	lb.	b.	lb.	b	lb.	b.	lb.	b	lb.	b.	lb.	b.	lb.	b.	lb.
Canberra	48	5	38	25	29	18	26	40	33	24	21	30	28	21	29	4	24	9	32	24
Hard Federation	41	3	42	42	26	4	24	2	....		17	39	26	44	24	57	22	41	23	48
Federation	37	30	32	46	....		23	59	. .		13	25	25	45	18	10	...		26	27
Clarendon	32	51	..		19	53	21	27	29	16	16	40	20	21	21	22	26	38	....	
Improved Steinwedel ..	38	23	31	55	.		....		39	1	23	11	23	50	23	26	..		....	
Gresley	...		42	30	....		....		33	11	.		..		.. .		27	27	34	59
Marshall's No. 3	....		....		....		27	41	34	28	. .		....		..		....		28	56
Yandilla King . .	....		27	7	..		...		32	0			..		.		....		....	
Warden	34	17	.. .		....		....		. ..		15	37	...		....		....		....	
Firbank	36	43	. .		..		....				17	40	...		....		....		....	
Bunyip	35	6	27	7	....		....		.. .		18	59	....		....		....		....	
Florence	33	17	24	22	..		....		...		.. .		27	0	24	16	21	9	....	
Major	....		....		25	1	....		. ..		....		....		....		....		....	
Roseworthy	....		. .		13	18	....		.				...		...		....		....	
Plowman's No. 3 .. .	....		.. .		....		20	37	....		....		....		....		....		....	
Plowman's No. 4	....		....		....		24	57	. .		.. .		....		....		....		....	
Wandilla	....		....		....		21	34	...		....		....		....		....		....	
Bomen	...		....		. ..		26	47	30	11	19	8	....		....		....		....	
Warren	....		....		....		....		35	57	.. .		23	44	21	32	....		....	
Zealand	....		....		....		....		21	39	....		....		....		....		....	
Hamel	...		....		....		....		...		....		32	11	....		....		....	
Gallipoli	....		....		....		....		....		. ..		32	3	....		....		....	
Glencope	....		....		....		....		....		. .		....		....		14	52	....	
Waratah	....		....		....		. ..		...		.. .		....		....		24	8	....	
Wilfred	....		. ..		....		....		...		....		....		. ..		23	6	...	
Oats—																				
Algerian	41	19	33	33	....		....		39	5	14	9	....		....		25	39	....	
Sunrise	52	22	21	23	....		....		35	25	20	20	....		....		21	29	....	
Lachlan	48	34	28	5	....		....		45	8	13	21	....		....		19	7	....	
Guyra	....		25	12	.. .		....		....		....		....		....		.....		....	

HAY Yields, Orange.

	t.	c.	q.	lb
Wheat—				
Bomen	3	13	0	0
Firbank	3	7	1	15
Warren	2	10	1	0
Oats—				
Algerian	2	19	0	17
Sunrise	2	15	0	22

Notes on Varieties.

The variety *Canberra* has again proved itself a consistent bag-filler in the western districts, and continues to increase in popularity. It was the variety most frequently met with amongst the many crops inspected during the past season, and was noted for the well filled heads of plump, heavy grain. It is safe to sow this variety upon fairly extensive areas from the middle of May.

Improved Steinwedel has yielded well where tried, but as it has a tendency to shatter, only small areas are recommended. Other early varieties, such as *Hard Federation*, *Florence*, and *Bunyip*, are already well known.

Of the later wheats for early sowing—April and early May—*Marshall's No. 3*, *Bomen*, and, to a lesser extent *Rymer*, *Yandilla King*, and *Currawa*, will give best results. *Warden*, which gave a yield of over 34 bushels per acre at Trundle, is looked upon as being more of a hay than a grain wheat; it should be sown about the end of April. While growing, *Clarendon* created a great deal of interest, being a quick grower, tall, and of good colour, but the yield of grain was rather disappointing, excepting from the plot at Gilgandra. This variety may prove suitable for the heavier type of soils, where rust is often prevalent. It would certainly produce a good yield of nice quality hay, and may be sown about the middle of May onwards

Gresley, a new variety to the district, was produced in West Australia from a Federation and Huguenot cross. It has yielded remarkably well in the four plots where tried. It is also a good early hay wheat, and should be sown about the middle of May. Next year it will be included in all the plots of the western district, and it is likely to become popular.

Hamel is a West Australian wheat—a cross between Gluyas and a stronger straw variety. It is rust-resistant, tall, with fairly fine straw, good colour, and early. It topped the yields for grain in one of the Narromine plots, and would make nice quality hay. The variety was only tried in one centre, and owing to the favourable results its trial will be extended next season.

Gallipoli.—This wheat originated at the Werribee Farm, Victoria, and is a crossbred (Club x Yandilla King). It was only tried in one plot (Narromine), where it yielded only a few pounds below Hamel. Unfortunately the strain sown was not a fixed type, and the yield therefore not strictly comparable.

With early hay sorts, such as *Firbank*, *Clarendon*, and *Gresley*, it is quite possible for the Bogan Gate-Trundle district to place the major portion of the new season's chaff on the market before other districts can truck, thus gaining the advantage of the temporary high prices ruling during most years, especially after the breaking of a drought.

Warren is an early to midseason variety, and is recommended either for hay or grain for the Molong district, to be sown about the beginning of May.

The Need for Stud Seed.

The opinion is often expressed that Federation is not what it used to be—that it is running out. Could we expect otherwise if a variety is grown for about twenty years without any attempt being made to maintain the quality and purity of the variety, either by the production or the purchase of pure stud seed? The laws of breeding are the same for plant as for animal life. What would be the result of allowing a hundred stud ewes and a couple of stud rams to breed indiscriminately for twenty years without the guiding influence of man?

Provided pure stud seed is sown, Federation is as good as ever it was, although new varieties have been produced which yield better under certain conditions in the western district. If care is not exercised, even such varieties as Canberra and Hard Federation will gradually lose favour as the years go by. Practical results show that a variety sown on the experiment plots usually yields higher than the same variety sown over the rest of the paddock, although the cultural operations, amount of seed per acre, manure, and time of sowing are identical, the only difference being that the Department of Agriculture supplies stud seed for sowing in the experiment plots.

Supply of Stud Seed Wheat.

The Department of Agriculture is only able to supply a limited quantity of stud seed from the experiment farms, and of this a large quantity is required for the sowing of the farmers' experiment plots. These farmers' plots have now been established in most of the wheat-growing centres of the western district, and the farms where these plots are established are the main source of pure seed-wheat for the surrounding districts. Each variety sown in these plots has an area of 2 acres, and is carefully harvested, the seed being sown the following year on fallowed land. The field crops are inspected by an officer of the Department for purity and type, and later a sample of grain is forwarded to the Department, where it is tested in the laboratory for freedom from foreign matter, and germination percentage. When the seed has passed all tests it receives the recommendation of the Department of Agriculture, and is listed with the grower's name in the "Pure Seed" list published monthly in the *Agricultural Gazette*.

The plots and field crops are always open for inspection by interested farmers. The price per bushel is not a departmental matter, being left entirely with the farmers, but it is generally about 2s. to 2s. 6d per bushel above the f.a.q. price, so that the additional cost of growing small areas of several varieties and keeping them pure, storage, additional handling, grading, dispatch of orders, correspondence, and so forth may be covered. At this price such seed is certainly cheap. The present issue of the *Agricultural Gazette* contains a list of growers of pure seed wheat, of which, so far as western district growers are concerned, in most cases, the crops have been produced from seed originally supplied by the Department.

There are a few growers in the western district who produce their own stocks of stud seed-wheat, and, provided their crops pass the prescribed inspections, their seed-wheat receives equal recommendation from the Department.

North-western District.

MARK H. REYNOLDS, Inspector of Agriculture.

THE wheat season of 1921 will be known in the north-west as one of good rainfall but poor yields, although, of course, there were instances in every portion of the district of high yields. The cause of this may be summarised as faulty methods of farming and want of knowledge of suitable varieties.

In the report on the 1920 wheat season it was noted that farmers were, with few exceptions, sowing the whole of their cultivation area, which was to be expected, following a year of drought. In later visits to the district in 1921, a similar state was noted, and only in rare instances was any attempt made to carry out good farming methods—that is, to fallow a section of the farm in order to rid the land of weeds, to bring it to a healthy condition by eliminating undesirable fungoid and insect pests by starvation, and to conserve moisture.

My observation of the land fallowed in the north-west to-day suggests that the bulk is new land broken to cultivation since last harvest (1921), and but rarely is a stubble paddock from the 1920 crop under fallow.

Biological experts have clearly pointed out that the "foot-rot" and take-all fungi attack barley and spear grass as well as wheat, and it is, therefore, a matter of doubt whether the areas of pasture land now under fallow are not as badly affected with those diseases as the present wheat stubble fields. The experience of the past has taught us that such fungoid pests as rust, bunt, take-all, and, probably foot-rot, vary in degree of severity in the effects on a crop according to the season. Our experience of this season indicates that very wet autumn and winter conditions are the most favourable for foot-rot. If such conditions again prevail this coming season, there is every prospect of another year of unsatisfactory returns where the crops are growing on land occupied by diseased wheat last season. If, however, as we all sincerely hope, the suitable weather conditions for foot-rot and take-all do not occur there will still be a minor affection sufficient to carry forward the disease each year until we get a repetition of 1920 and 1921. The field officers of the Department would, therefore, join in stressing the importance of each and every farmer in the north-west leaving out this year a portion of his wheat area and thoroughly fallowing it, or at least growing only those crops the Department recommends as free from these diseases, but in such a way as to enable intercultivation to eradicate weeds.

Next in severity to fungoid pests is the weed pest, and throughout this district stinkwort, thistles of many varieties, and numerous other weeds are getting control of the cultivation areas. Without being unmindful of the many handicaps north-west farmers have to put up with, it is necessary to stress the serious position that farmers will have to face unless they revert to methods many of them have proved most successful in other parts. Many good farmers with years of experience, in reviewing their fallowing efforts in this district some years ago, found they had got little or no increase in yield, but no two seasons are alike, and at the time they were fallowing there was no great menace of fungoid and weed pests.

A Crop of Tartarian Oats at Guyra.

Concerning the season 1921, it was found that the foot-rot fungus (*Helminthosporium*) caused greatest damage in fields where wheat was grown the preceding year. It was also noted that its effects were more serious on low-lying or flat country, and least on slopes. Although present, and affecting the crop, it only did so to a minor extent where the wheat was well established prior to the very wet weather of May, June, and July. It was not noticed at all on fallowed land, or on land that had been occupied by maize in 1920.

RAINFALL recorded during Growing Period.

	April.	May.	June.	July.	August	Sept.	Oct.	Nov.	Dec.
	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.
Quirindi ...	...	...	...	297	91	218	301	204	42*
Manilla	..	330	267	297	103	129	518	220	..
Tamworth ...	...	...	510	180	27	165	...	247	...
Boggabri ...	327	392	394	292	134	187	330	...	..
Baan Baa ...	...	342	433	369	64	106	463	..	...
Curlewis ...	...	335	327	300	82	58	430	201	...
Narrabri ...	237	484	780	330	75	110	358	...	...
Wee Waa ...	...	115	806	355	90	97	394	25	...
Delungra ...	...	...	...	602	66	216	305	420	236
Pallamallawa ...	...	...	505	429	87	173	204	125	...
Newstead North	...	...	...	..	91	305	452	477	91
Gunnedah ..	...	355	337	350	95	67	352	167	...

* To 4th of the month only.

It was again noticed that Federation and Hard Federation were both severely affected with rust, and that in all varieties the affection was least on the slopes and greatest on the flats. Where wheats had not reached a certain stage of maturity, or had passed that stage when the weather conditions were favourable to rust, the crops were practically free. With one exception Warren wheat was singularly free from rust, thus bearing out the previous experience of the Department.

Although there was a greatly reduced yield throughout the district, the quality of the wheat garnered was above that of the previous year, and much was of excellent quality.

Cultural Details.

Gunnedah.—The plot here was located on fallowed land broken from pasture, the land being twice ploughed and cultivated before sowing. Taken all round the yields were the best in the north-west plots, but were materially reduced by poor germination, probably caused by bluestoning too severely for bunt prevention. Major, Bomen, Currawa, Hamel, and Hard Federation were sown on 10th May, and Sunset, Bunyip, Improved Steinwedel, and Gresley on 2nd June. The quality of the wheat was good. The plot could have been fed off with advantage, but the continuous wet weather prevented this, as bogging would have resulted. In Hamel, Bunyip, and Sunset the straw was weak and lodging occurred. Only a minor affection of rust was observed; foot-rot, take-all, and bunt were not noticed.

Newstead North (Inverell).—Black sedimentary soil; wheat had not been produced on the site previously. The land was ploughed three times from May to August, 1921, and plots sown on 11th August. The germination was faulty, apparently owing to over-bluestoning, and the crop too thinly covered the ground, thereby inducing rank growth and permitting thistles to grow, and also enabling wind to have greater effect on the crops.

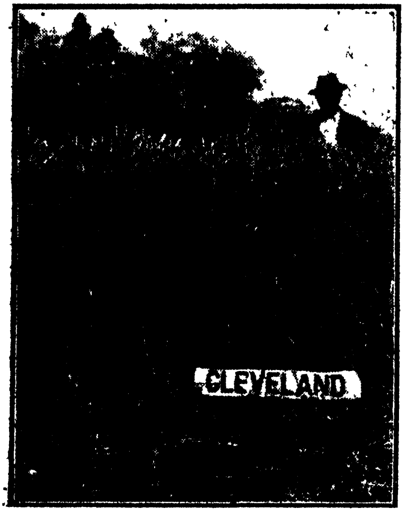
The behaviour of the several varieties under these adverse conditions noted on 21st December will be of interest:—Improved Steinwedel was very badly rusted; tangled and lodged mostly at one end of field. Gresley was badly rusted, but was not so badly lodged as Improved Steinwedel. Warren was practically rust free, but tangled and lodged badly. Canberra was badly rusted on a par with Gresley, but lodged and tangled in a less degree than Warren. Florence was rusted but not so badly as Canberra; lodged to minor extent, much less than Canberra. Currawa was only slightly affected with rust; it was much later than any of the foregoing, but lodged badly. Clarendon was very rust free, but lodged badly. Waratah stood up best of any and only slight rust was showing on the flag.

The order of maturity will also be of interest:—Canberra and Florence were earliest, being about equal in maturity. Gresley was next, and it was followed by Improved Steinwedel, Clarendon, and Warren Then came Currawa, and latest of all Waratah. Warren is noted for its rust resistant qualities, but any selection given to date has apparently not strengthened the straw. It would appear that the later maturing varieties (Currawa, and Waratah), had not reached the stage most suitable for the attack of the rust fungus when optimum weather conditions for such infection occurred or they showed very rust-resisting qualities. Subsequent to to 21st December further damage to the crop was caused by wind and rain.

The crop was sufficiently mature from 21st December to 30th December to have been cut with a reaper and binder and threshed afterwards. I am of opinion that wheat-growing can be successfully carried out from Delungra, through Inverell, to the foothills twelve miles from Glen Innes, on the black and dark chocolate soils, provided the harvesting method is cutting with reaper and binder and threshing.

The yield obtained from this plot was not comparable, but had varieties not badly rusted been garnered, good quality grain and satisfactory yields would have resulted. Special mention is made of this plot as it is somewhat a pioneer in a tract of country now chiefly used for pastoral purposes. Mr. Bucknell had the thistle removed and did everything possible to protect the plots. It is suggested that on similar country other crops than wheat or oats for grain should be grown for a couple of years. Maize or wheat and oats for hay may be mentioned as likely to be suitable. Apart from rust, no disease was noticed at the Newstead plot.

Pallamallawa.—The land was occupied by wheat in the previous year, no manure being applied. Unfavourable seeding conditions prevailed (sowing took place between 24th June and 3rd July), and germination was very faulty, plants being thinly distributed. Hard Federation, Major, Gallipoli, and Canberra were the most seriously affected with rust, Wilfred and Waratah only slightly, and Cleveland was practically free. Sunset proved weak in straw and a bad stooler. The comparatively low yields from this plot, compared with the yields from Bomen, Queen Fan, and some similar wheat on other sections of the farm (also sown on land occupied by wheat the previous year) tends to illustrate the benefit of sowing wheat of good germination percentage, and also the losses that may be caused by too much rain about the time of sowing. Sowing under such conditions will put the soil out of condition and encourage attacks of foot-rot and other fungi already present in the soil.



A plot of Cleveland Wheat at Delungra.

Delungra.—The soil was of a dark chocolate to black basaltic loam; previous crop, maize, no manure; sown on 19th and 20th July. The different varieties stood up well, and although rust was noticeable in some more than others, no appreciable damage resulted. The striking result was the yield of Warren, indicating that under certain conditions this variety will stand up satisfactorily and yield well; it was very free from rust. A wheat that is growing in favour in the district is Queen Fan, which is also thought well of by the Plant Breeder of the Department.

Wee Waa.—The plot was located on free working red loam; previous crop, wheat in 1920, no manure having been applied. Steinwedel, Florence, and Sunset were sown on 24th June, and the balance on 27th May. The various wheats stood up well, excepting Sunset and Comeback, and rust did little damage, except in Hard Federation. Wilfred also lodged to a small extent, and was affected next in severity to Hard Federation, but not seriously.

Narrabri.—Red sandy loam, somewhat level; land rested in pasture during 1920, ploughed twice in autumn 1921, in preparation for the trials. Sowing took place on 9th April, but Florence, Canberra, and Sunset were delayed until 25th May. Satisfactory germination and stooling occurred, except in the three late sown varieties, and the last was the only variety that lodged. The land occupied by the late sown varieties was more flooded by the excessive rains in autumn and winter, and generally they had comparatively unfavourable conditions. No disease affected the resultant yield.

Curlewis.—Soil, red, free working loam; previous crop, wheat, no manure. Although great attention was given in the ploughing, cultivation and seeding, faulty germination and stooling resulted, apparently due in part to the foot-rot fungus. A seeding of 52 to 54 lb. to the acre was made. The early sowing took place on 7th May; Gresley, Sunset, and Canberra were sown on 9th July.

Baan Baa.—Soil, red, free working loam; situation, slightly sloping to the north; previous crop, wheat, no manure; Red Wing, Major, Bomen, and Currawa were sown on 20th April, and the balance on 12th May. The early sown portion was well established before the excessive rains of May, June, and July. Gallipoli, Hard Federation, and Red Wing were slightly affected by rust. Florence lodged partly, and Sunset was the poorest stooler. Foot-rot disease was not apparent on these plots. The crop stood up well for harvesting.

Boggabri.—Soil, free working, red loam; situation level; previous crop, hay, 1920; Gallipoli was sown on 5th April, and the rest on 5th to 10th May. I attribute the low yields to the excessive rain and stagnation of water in the soil, and to the sowing being at the time of soil saturation; the shallow cultivation of the soil accentuated the damage. The cultivation methods of sound farmers, like Mr. Studd, got a rude shock in this extraordinary season.

Loomberah (Tamworth).—Soil, red, free working loam; previous crop, wheat, in 1920; sowing took place on 23rd June; poor germination and foot-rot both materially affected the yield, but the grain harvested was generally of good quality. Of the main crops on the farm it was noticeable that the portion sown early in the autumn had escaped material damage from foot-rot, and satisfactory yields resulted, especially on land not sown to wheat in 1920.

Manilla.—Soil, red, free sandy loam; previous crop, wheat, in 1920, yielding 30 bushels to the acre. The wheats had only just been sown on 10th and 11th May, when the extensive rains commenced. The result was a very poor stand and very poor stooling. It was found on investigation by the Biological branch that both take-all and foot-rot were very prevalent, and these diseases accounted for the very low yields.

Quirindi.—Soil, rich, dark red to grey, regularly enriched in wet seasons by minor flooding from surrounding hills; situation somewhat level; previous crop, wheat, in 1920. The result, considering the season, was very satisfactory. Sowing was made on 20th July. The effect of the season, soil, &c., on the several varieties will be of interest:—Yandilla King made a poor germination, stood up well, rusted badly; Clarendon rusted, crop leaning, but only lodged in patches. Glencope was more severely rusted than Clarendon; crop leaning, and patches lodged, but not as badly as Clarendon. Hard Federation was badly affected with rust, and the grain was badly pinched. Warren was as badly affected with rust as Clarendon, especially at the lower end of the field; the crop was tangled, lodged, and leaning in large patches. Canberra was not as badly rusted as Warren; leaning, and odd patches lodged. Florence was leaning, but not lodged; rusted as badly as Glencope. Bomen was rusted badly—next in severity to Hard Federation; foot-rot was apparent throughout the plots.

Variety.	J. J. Perry, Quirindi.	Bignold Bros., Manilla.	W. H. Lye, Loomberah.	R. A. Studd, Boggabri.	Lennox Bros., Baan Baa.	E. J. Young, Curlewis.	E. M. Palmer, Narrabri.	Jas. Cherry, Wee Waa.	Wm. Tonkin, Delungra.	J. T. Maunder, Pallamallawa.	A. G. McDonald, Gunnedah.	N. C. Bucknell, Newstead N., Inverell.
	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.	
Yandilla King	14	7¾	10	...	.	...	...	...	...	. .	..	Not comparable, due to lodging, &c.
Bomen	19	...	...	...	21	14¼	..	..	29	..	28½	
Florence	23⅛	8¾	..	13½	†	...	25	20	21	.	...	
Canberra	28	7¼	19	14½	21½	13½	26	..	26	19	...	
Warren	26	...	13	10	..	...	22½	..	31½	. .	...	
Hard Federation	11½	9¾	15¾	13	23½	15	24½	20	18	19¼	27	
Glencope	12	...	...	.	...	...	22½	..	.		...	
Clarendon	29	12	...		..	14	21		...	.	..	
Wilfred	..	12	18	...	...	...	...	28	27	.	...	
Red Wing	..	11	13	...	22	...	...	..	...	29	..	
Improved Steinwedel ..	...	7	...	14	..	...	.	20	...		27½	
Sunset	...	8	...	8	*	9	14	*	..	13½	19	

Variety.	J. J. Perry, Quirindi	Bignold Bros., Manilla	W. H. Lye, Loomberah	R. A. Studd, Boggabri.	Lennox Bros., Baan Baa.	E. J. Young, Curlewis	E. M. Palmer, Narrabri.	Jas. Cherry, Wee Waa.	Wm. Tonkin, Delungra.	J. T. Maunder, Pallamallawa	A. G. McDonald, Gunnedah.	N. C. Bucknell, Newstead N., Inverell.
	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.	
Waratah	...	...	8	...	...	...	...	...	...	19	...	Not comparable, due to lodging, &c.
Major	...	...	5½	...	32	...	...	..	...	19¾	18	
Gallipoli	...	...	..	12½	. .	...	...	...	..	22¾	..	
Penny	..	...	...	11½	...	...	...	..	...	...	...	
Currawa	...	...	...	...	27	16½	33	34½	...	...	35½	
Comeback	...	...	...	. .	...	12	..	*	...	...	...	
Gresley	...	...	..	...	...	7	...	...	21	...	22½	
Federation	...	...	...	...	...	...	...	18½	...	...	...	
Cleveland	...	...	...	...	..	..	...	...	24	26	...	
Hamel	...	...	...	...	...	...	...	...	...	...	17½	
Bunyip	.	...	...	....	...	...	...	...	...	...	25	

* Lodged and not comparable; yield less than other varieties. † Not comparable.

Central Western District.

W. R. BIRKS, B.Sc. (Agri.), Inspector of Agriculture.

THE cereal experiment plots in the central west in the past season were located on the farms of the following gentlemen:—

H. O. McColl, "Strathmore," Koorawatha.
W. Burns, "Goongirwarrie," Carcoar.
F. S. Stacey, "Combandry," Gulgong.
L. C. Sands, "Combandry," Gulgong.
Robinson Bros., Tallawang.
J. Mathias, Oban, Coolah.
L. C. J. Broughton, "Berrima," Mendooran.
V. Granowski, "Mooren," Binnaway.
H. B. Loveband, "Blenheim," Coonabarabran.

These localities represent a variety of climatic and agricultural conditions. Koorawatha is typical of first-class wheat country, with uniformly fertile soil and reliable rainfall. The district served by the Mudgee-Coonabarabran line and represented in the above list by the Gulgong, Tallawang, Coolah, Mendooran, and Binnaway plots contains areas of first-class wheat land, cut up by belts of lighter soil and sandstone ridges. The rainfall here is also inclined to be more irregular. Carcoar and Coonabarabran border on the 30-inch rainfall, and the conditions in these centres approach more or less those of the tablelands. Added to these variations of soil and climate, there were unusual seasonal phenomena, including an excessively wet autumn and winter, followed by a comparatively dry and early spring. These circumstances have combined to produce great and rather puzzling variations in yields, as shown in the accompanying tables of yields; and these represent more or less accurately the general experience of the district.

The rainfall, roughly averaged for all centres, is represented as follows:—

	Rainfall on fallow.		Rainfall on growing crop.
October	1·15 inches.	May	3·81 inches.
November	2·18 ,,	June	3·89 ,,
December	4·80 ,,	July	1·68 ,,
January	1·95 ,,	August	1·25 ,,
February	·65 ,,	September	1·35 ,,
March	3·50 ,,	October	1·28 ,,
April	4·50 ,,	November	1·91 ,,
Total	**18·73 inches.**	**Total**	**15·17 inches.**

Conditions were favorable for seeding only during the early autumn, up to the third week of April. Thereafter frequent and heavy rains not only delayed sowing operations but also weakened, and in some cases drowned out the wheat already sown. The winter thus left the crops in a condition in which they were more than ordinarily susceptible later on to the attacks of such diseases as take-all. Spring conditions set in early (in some localities in July) and the rain thereafter, though fairly well distributed, was not

generally sufficient to allow of the crops recovering to the full extent. Early sown crops on rich ground generally did well, particularly on fallow. Late sown wheat was thin and inclined to "spindle" as a result of the early spring, and the returns on the lighter types of soil were everywhere erratic and disappointing, irrespective of the care devoted to the preparation of the land.

The individual plot yields are set out in the accompanying table showing the result of the variety trials. It will be seen these range from a little over 3 to 13 bags per acre. At Coolah the plots were so poor and irregular as not to be thought worth stripping separately. The soil in this case was a rather deep, light, red sand, that is to say, one from which the elements of fertility might be expected to be washed out by excessive rain. In this connection, it is of interest to note that during the period June, 1920, to July, 1921, inclusive, 54½ inches of rain fell at Coolah. In no other centre was the rainfall less than 40 inches for the same period, and at Coonabarabran the total slightly exceeded that of Coolah. Such a precipitation is far in excess of that normally experienced in twelve or thirteen months, and it is not to be expected that the lighter wheat country of the west could yield well under such conditions. This excessive washing possibly explains why the natural fertility of the land has had a greater influence on crop yields this season than usually, and why the natural moisture-retaining qualities of lighter soils have had a lesser effect.

WHEAT Variety Trials.—Grain.

Variety.	Koorawatha.		Tallawang.		Mendooran.		Coonabarabran		Gulgong.	
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.
Canberra	34	35	......		18	50	17	0	14	10
Hard Federation	30	45	25	0	13	30	13	0	15	40
Federation	33	50	29	0	......		16	45	19	15
Yandilla King	......		......		......		......		18	20
Marshall's No. 3	......		25	30	10	10	......		......	
Gresley	31	40	29	15	14	5	15	0	......	
Currawa	......		33	40	......		......		......	
Onas	39	10	33	10	......		......		......	
Zealand Blue	......		27	40	......		15	15	......	
Zealand	27	40	......		......		......		......	
Wandilla	34	50	35	10	......		......		......	
Waratah	33	50	29	40	......		......		......	
Warden	33	25	......		......		......		......	
Firbank	22	15	......		......		......		......	
Penny	......		28	35	......		......		10	0
Improved Steinwedel	......		22	25	17	10	......		......	
Florence	......		......		20	5	13	25	10	5
Major	......		......		......		......		19	50
Gallipoli	......		......		......		......		17	10
Clarendon	......		......		......		......		10	10
Glencope	......		......		......		20	0	......	
Warren	......		......		......		16	50	......	
Wilfred	......		......		......		14	10	......	
Cleveland	......		......		......		15	25	......	
Roseworthy	......		......		......		13	0	......	

Fallowing and Early Sowing again Vindicated.

In spite of these abnormal conditions and effects, the experience of the season has again proved the efficacy of the cultural methods recommended by the Department. After the abnormally favourable season of 1920, followed by heavy summer rains, a dry spell at some time in 1921 might have been anticipated. Prudent farmers were further inclined to this view by the heavy early autumn rains in March, and those who, farming for drought, sowed early on fallowed land, had good conditions for seeding, and in the great majority of cases grew good crops.

Varieties.

A rather numerous selection of varieties had to be made to meet the various farming conditions occurring in the district. Trials of any group of varieties, therefore, are not sufficiently correlated to allow of a definite comparison of varieties. Speaking generally, however, from the experience of the district as a whole, as well as from the plot returns, the following broad suggestions may be indicated:—

Varieties for main wheat areas.—Hard Federation, Canberra, Federation, Yandilla King, and Florence.

Promising new varieties.—Wandilla, Waratah, Onas, Wilfred, and Major.

For districts subject to rust.—Currawa and Clarendon.

For hay-growing districts.—Zealand, Warden, Zealand Blue, and Gresley.

For all purposes on the tablelands.—Cleveland.

Cropping Systems.

The wheat plots were all sown on land which had been long-fallowed and cultivated on the average three times, as circumstances demanded. Seeding was effected during May, and the crop rotations employed in the different localities were as follows:—

At Koorawatha, Gulgong, and Mendooran.
1. Fallow.
2. Wheat.
3. Oats and Barley.

At Tallawang and Coonabarabran.
1. Fodder crop and fallow.
2. Wheat.

Wherever possible, endeavours are made to retain permanent sites for these experiments, in order that an illustration may be provided of the value of the rotation in use. At the same time, the cumulative effect of the application of superphosphate with every seeding can be observed, and already, after four or five years of this treatment, stock are showing a decided preference for the natural feed coming on the stubbles of the permanent experiment plots.

The Manurial Trials.

The normal dressing is 56 lb. superphosphate. A manurial trial was incorporated with each of the wheat experiments and the returns are set out below.

MANURIAL Trial.—Wheat.

Locality and Variety.	Unmanured.		56 lb. Superphosphate.		84 lb. Superphosphate.		130 lb. Superphosphate.	
	bus.	lb.	bus.	lb.	bus.	lb	bus.	lb.
Koorawatha (Federation) .	30	0	33	50	...	...	38	0
Tallawang (Hard Federation) ..	27	45	25	0	29	25	.	...
Mendooran (Canberra)	17	50	18	50	20	5	...	..
Coonabarabran (Cleveland) ...	15	30	15	25	15	30	...	..
Gulgong (Federation)	11	50	19	15	18	0	...	...

Contradictory results occur here, largely from the effects of uneven waterlogging of the soil. In general, however, the efficacy of superphosphate is well brought out.

WHEAT and Oat Variety Trials for Hay at Carcoar.

	t.	c.	q.
Wheat—			
Cleveland	1	18	3
Zealand	1	10	0
Zealand Blue	1	7	3
Rosoworthy	1	5	3
Marshall's No. 3	0	15	1
Federation	0	14	3
Onas	0	14	3
Thew	0	14	1
Oats—			
Ruakura	0	19	2
Guyra	0	14	1

The plots were all treated with 56 lb. superphosphate per acre.

These plots were sown in a permanent experimental field, in which the rotation is—

1. Autumn fodder followed by short fallow and summer crops (potatoes and corn).
2. Cereals for hay.

The necessity for harvesting and cleaning up after the summer crops delayed seeding until the middle of June, which turned out to be, in this season, a particularly heavy handicap. The results, however, illustrate the almost unrivalled excellence of Cleveland for tableland conditions. It was, among other things, the only variety practically unaffected by rust.

Oats and Barley Trials.

For the purpose of testing the newer varieties, and to demonstrate the method recommended for utilising wheat stubbles for a second crop, oats and barley plots were sown in three localities. In each case the site had carried a wheat crop in 1920. The stubble was broken up as early as possible in the new year, and after a disc-cultivation the plots were sown towards the end of April. A dressing of 56 lb. of superphosphate was applied here also.

It will be seen that some exceedingly good yields were obtained, and compared with the returns from wheat on unfallowed land adjoining, the average bushel yields were roughly one and a half times to twice as great.

VARIETY Trials with Oats and Barley.

Variety.	Binnaway.		F. S Stacey, Gulgong.		Coolah	
Oats—	bus.	lb.	bus.	lb.	bus.	lb.
Algerian ..	54	15	26	0	23	0
Lachlan	50	15	...	...	25	30
Guyra	...	.	39	20	26	16
Ruakura ..	...	..	27	10	...	...
Sunrise ..	49	0	25	10	19	0
Barley—						
Cape ...	36	20	...	...	16	10
Trabut ...	..	...	20	0	17	0
Skinless ..	14	26	..	...	...	...

UTILITY OF ZAMIA PALM FOR STOCK FOOD.

EXPERIMENTS to determine the value of the products of the zamia palm (or Burrawong) for fodder purposes have been carried out by the Metropolitan Meat Industry Board in conjunction with the Department of Agriculture, and the results are likely to be of interest in view of the discussions that have taken place on the subject.

It was found that the cost of collecting the roots was £2 10s. to £2 17s. 6d. per ton, f.o.r., and the average railway freight, landed at the factory, 11s. 4d. per ton.

From the process of manufacture employed, three products were obtained in the proportions indicated, viz., starch, 6·5 per cent.; stock food, 52·12 per cent.; fibre and refuse, 41·8 per cent. The costs of the various processes necessary to obtain these products were as follows:—

	£	s.	d.	
Cleaning	0	11	3	per ton.
Disintegration	0	14	0	,,
Steepage	0	5	8	,,
Drying	1	5	0	,,
Separation starch	1	10	0	,,
Refuse	0	18	0	,,
Milling	0	10	0	,,
Bags	0	12	6	,,
	£6	6	5	

The stock food was tested with poultry and pigs. In the case of the poultry, six birds were fed with the zamia palm food, against six fed with normal rations. A reduction of 38 per cent. in egg-production commenced in the former pen nine days after the commencement of the test, which was continued for one month. In the case of the pigs, three fed on usual foods were sent to market three weeks ahead of those fed on the zamia palm material.

The conclusion reached was that the costs were altogether out of proportion to the value of the food manufactured, and it does not appear that the zamia palm can be used with commercial success, at least in this direction.

Soil Improvement Under Irrigation.

GREEN MANURING TRIALS AT LEETON, 1921.

A. N. SHEPHERD, Assistant Inspector of Agriculture.

ONE of the problems, if not the chief problem, with which the settler on the Murrumbidgee Irrigation Area is confronted is that of the improvement of the mechanical condition of the soil. It is very noticeable, for instance, that the trees in many of the citrus orchards on the lighter sandy soils are turning an unhealthy yellow colour. In many cases these trees receive good attention, but it is significant that only in a few instances does the grower use fertiliser and that green manure crops are rarely grown In view of these facts the series of green manurial trials commenced in 1920 by Mr. J. Hetherington, of Farm No. 338, Leeton, are of decided interest. The soil on this farm is of the light type in question.

Ploughing under Tick Beans.

The crop was higher than the horses in places.

It is very noticeable after only a few years of green manuring that the trees on the treated area are much healthier than those on adjacent ground that has not been green manured, and that the growth is greater. Although these results cannot be entirely attributed directly to green manuring, the practice is evidently worth while. The raising of the green crop necessitates the land being in good order, and attention to cultivation and judicious irrigation which otherwise it might not receive.

It has been noticeable, too (though this would not always obtain), that where the green crop was present no water lay even after a heavy rainstorm or irrigation, whereas in previous years water would be in evidence for some little time. Again, the green crop protects the land and trees from frost and driving winds. A block of young citrus, half of which had been planted to a crop and half of which had been worked bare, was recently brought under the notice of the writer as an instance of this; the trees in the area carrying the crop had made better growth than the others.

Mr. Hetherington's farm has a very fine block of citrus on light soil, and the trees are a picture of health, and are producing great crops. This plot has received liberal dressings of fertiliser for a few years, as well as having a green crop ploughed in.

The same ground after the Tick Beans had been ploughed under.

The design of last season's trial was as follows :—

Plot.	Crop Sown.	Rate of Sowing per acre.
1	Cape barley	1 bushel.
2	Grey field peas	1 bushel.
3	Skinless barley	1 bushel.
4	Skinless barley and vetches ...	Barley, 1 bushel; vetches, 20 lb.
5	Skinless barley and peas ...	Barley, 1 bushel; peas, 20 lb.

It was intended also to sow a plot with Tick beans, which had been proved by earlier trials to be an excellent crop for green manure, but seed was not available at the time of sowing on 4th April. A portion of land adjoining was sown with tick beans a week later at the rate of 1 bushel per acre. A good germination was obtained and rapid growth followed. The crop received a watering in May, and this greatly assisted it.

A portion was cut and weighed on 10th August, previous to ploughing under, and, as in previous years, a much heavier weight was obtained from the beans than from any of the other crops.

The plot was ploughed with the single furrow plough, this implement completely covering the crop, as shown in the accompanying illustration. A chain was attached to the plough to assist in the operation.

A Heavy Crop of Tick Beans.

Skinless Barley.

The yields of the crops were as follows :—

	t.	c.	q.	lb.		t.	c.	q.	lb
Tick beans	16	7	1	7	Cape barley	7	6	2	0
Skinless barley and vetches	7	19	2	7	Skinless barley	7	3	2	0
,, ,, and peas ...	7	17	3	14	Field peas	7	0	1	6

A dressing of 70 lb. of superphosphate was applied when the seed was sown.

For bulk of humus and nitrogen supplying capacity Tick beans have given the best results for the past two seasons.

Coonabarabran Field Wheat Competition.

[The following is the report of Mr. W. R. Birks, Inspector of Agriculture, who, with the approval of the Minister of Agriculture, acted as judge in the above competition in the past season.]

THE scale of points adopted in this competition differed considerably from that generally used in similar competitions, and the totals are, therefore, a good deal lower. The general standard of the crops entered, however, compares very favourably with that in other districts. In fact, Mr. Failes' winning crop would have made a very creditable showing in the Royal Agricultural Society's competition this year. This crop promised a very heavy yield of wheat, and very little in the way of fault could be found. It was the purest of all the crops seen as far as type goes, and the variety (Cleveland) is one which can be highly recommended for the Coonabarabran district. It was free from black oats and other weeds, and the only trace of disease was a strip of smut apparently due to one bag of seed missing the pickle. A deduction was made under the heading "cultivation," as the ground was ploughed very late and the crop ran the risk of suffering from lack of moisture if the winter had been drier than was the case.

Mr. MacDonald's crop suffered the occurrence of a good many "strangers" in the Federation, as well as from a trace of smut and a few thistles; but on the whole, this, too, was a very fine crop.

Of the others, Mr. Beazley's was an exceptionally clean and healthy crop in spite of the fact that the ground has been continually under cultivation for about forty-five years. This land was ploughed in January, the earliest working met with, and this, together with another thorough working just before seeding, would tend to give the wheat a good chance in every way.

Mr. Newman, at Baradine, was unfortunate in being compelled to hold his sheep on the wheat until 25th August. This is dangerously late feeding-off in any year, but particularly so this season as the rainfall after July was light everywhere, and at Baradine the effective rain during this period was practically negligible. Given equal treatment this entry would have had a very good chance of developing into a winner. As it was the "Ashby" crops, consisting of several hundred acres of thoroughly clean and even wheat, were the best example of consistent good farming met with.

Mr. Richardson's was undoubtedly the heaviest crop entered. It suffered, however, from two serious disabilities. It was grown from seed procured during the drought, and contained a number of different varieties, and it was also fairly heavily affected with smut. It is difficult to explain why this crop should be smutty when the district as a whole was comparatively clean. One factor, possibly, was the low strength of the pickle used, viz., ¼ lb. per kerosene tin of water. Double this quantity of bluestone would probably have been more effective.

Mr. Higgins' crop, though heavy in places, was, for the most part, almost as heavily infested with black oats as it is possible for a crop to be; the method of cultivation adopted would contribute to this result. The land, which had carried eight previous crops, was merely ploughed in April and sown in May, without any cultivation to kill weeds before sowing.

Much of the wheat in this and surrounding districts is treated in the same way, but nothing could be better calculated to favour the spread of black oats at the expense of wheat. Among the very first essentials in successful wheat growing must be reckoned the practice of ploughing as early as possible and cultivating immediately before sowing with an implement which will cut all weeds. The spring-tooth cultivator does not always fulfil this condition, and the one-way disc, skim-plough, or heavy scarifier is better where strong growing weeds are to be dealt with.

Another essential for prolonged success with wheat is the regular "spelling" of the ground. Of the crops entered, only two were sown on ground which had not carried wheat last year, and these crops occupy first and second places.

Every year more and more practical farmers are realising that it does not pay to grow wheat year after year on the same ground, and this practice is being gradually abandoned in the south where the more progressive growers are more and more confining their wheat to fallowed land. In a district such as this, with a comparatively heavy rainfall, it is possible to grow other crops, and more intensive use may be made of wheat land than to throw it out every second year. The systems which are most likely to lead to success in the different parts of the district may be outlined roughly as follows:—

1. In the immediate vicinity of Coonabarabran and among the mountains.—Wheat, followed by barley or rape, sown in February for winter feed; maize, sown the following spring. If early varieties are employed the stalks can be disposed of, and the ground lightly cultivated in time to sow wheat the following autumn. This allows two cash crops and one grazing crop to be raised every two years, provided conditions are reasonably favourable.
2. In the warmer parts of the district (*e.g.*, Purlewaugh and Bugaldi).—Wheat followed by oats and barley; then fallow. This gives two crops in three years.
3. For the plains and drier areas, say beyond Baradine.—Wheat, and then fallow, or wheat, natural grazing, and fallow will probably be found to give the best results eventually.

These are all systems of farming which have been proved in practice, and which are being generally adopted in other districts with climates resembling those indicated above.

Another feature of the competition which cannot be passed unnoticed is the general impurity of the wheat grown in the district. In many cases the growers were quite hazy as to the pedigree of the seed they used, and in no case had the wheat been raised from pure-bred seed more recently than six years ago. It may be pointed out that at the Government farms the standard varieties are being continually improved, and a good deal of pure seed has been introduced into the district during the last year or two through the agency of the experiment plots.

Name and Address.	Preparation of Land.	Date sown.	Variety.	Apparent yield.	Trueness to type	Freedom from disease.	Freedom from weeds.	Evenness, &c.	Cultivation, &c.	Total.
L. J. Failes, "Mooeybah," Bugaldi.	New ground. Ploughed 1 May. Harrowed twice.	25 May	Cleveland	30	19	17	14	14	6	100
E. MacDonald, "Yunneena," Ulamambri.	Grassland. Ploughed 28 Feb Cultivated 24 April, 20 May.	25 May	Federation	28	16	15	13	14	8	94
A. T. Beazley, "Maderty," Coonabarabran.	Wheat stubble. Ploughed 30 Jan, 10 May. Harrowed 11 May.	12 May	Corel's No. 8.	23	16	18	15	13	8	93
C. W. Newman, "Ashby," Baradine	Wheat stubble. Ploughed 25 April. Harrowed 4 May.	7 May	Marshall's No. 3.	20	18	19	15	14	7	93
W. Richardson, "Netherlea," Ulamambri.	Wheat stubble Ploughed 5 April, 20 May. Cultivated 15 June.	20 June	Warren	33	11	9	13	14	8	89
W. J. Higgins, "Forest Glen," Coonabarabran.	Wheat stubble. Ploughed 15 April.	15 May	Canberra	20	17	18	5	11	5	76

Maximum points:—Apparent yield, 1 point per bushel; trueness to type 20; freedom from disease, 20; freedom from weeds, 15; evenness, condition, and general appearance. 15; cultivation and condition of ground, 10

POTATO BREEDING IN UTAH, U.S.A.

THROUGH a system of potato selection. whereby all strains were eliminated whose progeny for three to five years did not give yields of standard excellence, it has been possible to breed up a strain that has given as a six-year average a yield more than 60 per cent. greater than that for unselected seed - 307·0 and 190·7 bushels an acre, respectively. The high producing strain sets 18 per cent. more potatoes to the hill, and the average size of the tubers is 24 per cent. larger than for unselected. The germination of the selected strain is more rapid, the stand is better, the growth thriftier, and disease less apparent than for the unselected potatoes.—"Thirty years of Agricultural Experiments in Utah," Circular No. 46, Utah Agricultural College Experiment Station.

MACKIE'S CHEVALIER BARLEY.

SEED of the above variety was supplied to the Department for the purpose of a trial in 1919, but the first season disclosed that the seed was not pure. Selections were sown in 1920, the predominant type having an ear of medium length. As the variety received was named Mackie's Chevalier, it was concluded that the type with long ears was the correct one—resembling Invincible, rather than Standwell. It is about the same season as Kinver, and at least a week later than Pryor. Mackie's Chevalier appears to be a good barley; the grain seems to be of splendid quality. Seed is not available for distribution.—J. T. PRIDHAM, Plant Breeder.

COMMON NAMES OF USEFUL CHEMICALS.

IT sometimes happens that a chemical name is given to some commodity that the farmer is advised to purchase. Under its imposing title he wonders what it is, but really the substance is perfectly well known to him by its "common" name. Nobody goes to the paint shop and asks for two-pennyworth of sodium chloride when he wants common salt, and most of us have learnt that methylated spirits are pure alcohol with 10 per cent. poisonous methylated or wood spirit added for commercial purposes and to protect the revenue. Still there are many other common substances which are veiled under scientific names. Here are a few :—

Common Names.	Chemical Names.
Alum.	Potassium aluminium sulphate.
Ammonia.	Ammonium hydrate.
Baking soda.	Hydrogen sodium carbonate.
Bluestone.	Copper sulphate.
Borax.	Sodium biborate.
British gum.	Dextrin.
Carbolic acid.	Phenol.
Caustic soda.	Sodium hydroxide.
Chalk.	Calcium carbonate.
Chloride of lime.	Calcium chloride and hypochlorite.
Common salt.	Sodium chloride.
Cream of tartar.	Potassium tartrate.
Epsom salts.	Magnesium sulphate.
Glycerine.	Glycerol.
Laughing gas.	Nitrous oxide.
Litharge.	Lead oxide.
Liver of sulphur.	Potassium sulphide.
Oil of vitriol.	Sulphuric acid.
Pearlash.	Potassium carbonate.
Slaked lime.	Calcium hydroxide.
Spirits of salts.	Hydrochloric or muriatic acid.
Stone lime.	Calcium carbonate.
Sugar of lead.	Lead acetate.
Sulphate of ammonia.	Ammonium sulphate.
Verdigris.	Basic copper acetate.
Vinegar.	Acetic acid.
Washing soda.	Sodium carbonate.
White lead.	Basic lead carbonate.
White vitriol.	Zinc sulphate.

FOUR ARGUMENTS FOR FARM BOOK-KEEPING.

A FARMER has four good and sufficient reasons for keeping accounts:—

1. He should know how much he has saved during the year or over a term of years. An inventory taken at the beginning and at the end of a year will tell him this.

2. He should keep a record of what he buys on credit and what he sells on credit, so that he will know how much he owes, and how much other people owe him.

3. He should know whether or not he is required to pay an income-tax, and, if he is so required, he will need to make out income-tax returns.

4. He should know which parts of his farm business are paying and which are not.—H. M. ELIOT, in Michigan Agricultural College Experiment Station *Quarterly Bulletin.*

Farmers' Experiment Plots.

WINTER GREEN FODDER EXPERIMENTS, 1921.

Western District.

H. BARTLETT, Inspector of Agriculture.

WINTER fodder trials, forming a section of the rotation experiments which are being carried out in several centres of the western district, have again produced most favourable results. The object of the experiments is to popularise mixed farming (sheep and wheat), especially on the smaller holdings, by the introduction of a suitable rotation which will increase the stock-carrying capacity of the farm by providing green feed at a time when it is most needed, and at the same time maintain, and perhaps increase, the fertility of the soil. The farmers conducting the experiments are not restricted as to the use of the crop ; it may be fed off by the class of stock most in need of the fodder, or, if not required for grazing, it may be turned into silage. After the crop has been utilized in this manner, a growth is allowed to take place, which is ploughed under when the fallow is ploughed, thus adding humus to the soil. Even after cutting the crop for silage, a second growth of sufficient density for this purpose usually takes place. The rotation is being carried out according to the system advocated in an article in this *Gazette* for November, 1921, (p. 775), and there is undoubted evidence that it will become popular. Five growers who are directly interested in the trials have intimated that they will be sowing from 50 to 60 acres of winter fodders next season, and one of these growers intends to adopt the system over the whole of his farm.

The winter fodders will be most profitable if grazed with sheep, and the soil will be left in better condition for future cultivation ; but it has not been convenient to draft off a suitable number of sheep for the feeding off of such small areas (7 to 16 acres), which, being close to the homestead, have mostly been grazed with working horses and milking cows. The animals showed remarkable improvement, even though last autumn and winter were favourable from a grazier's point of view.

The trials were conducted in co-operation with the following farmers :—

S. Reilley, jun., Eurimbla.
D. A. Rich, Curra Creek, Wellington.
J. Parslow, Collie Road, Gilgandra.
W. W. Watson, Tichborne.
E. J. Allan, Gregra.
W. F. Dalton, Orange.
E. A. Draper, Alectown West.

The rainfall figures (where available) over the growing period were as follows :—

Month.	Tichborne.	Gilgandra.	Gregra.
	Points.	Points.	Points.
March	165	232	170
April	272	648	265
May	272	327	307
June	253	308	217
July	154	175	198
August	163	143	210
Total	1,279	1,833	1,367

Details of the Plots.

Eurimbla.—Soil, fairly heavy red loam; area, 11 acres; previous crop, oats, 1920. Ploughed early March, harrowed 23rd March, sown 23rd March. Mixture (1): Warren wheat 1 bushel per acre, Canada field peas ½ bushel; 5 acres. Mixture (2): Skinless barley 1 bushel per acre, rape 4 lb.; area, 6 acres. In each case superphosphate was applied at the rate of 56 lb. per acre. The wheat and barley made excellent growth, the peas poor growth, and the rape failed to germinate.

These plots carried thirteen horses and one cow for sixty-nine days, and 200 sheep for six days.

Curra Creek.—Soil, red to grey loam; area, 11½ acres; previous crop, oats, 1920. Ploughed February, harrowed early March, sown 5th March. Mixture (1): Gresley wheat, 1 bushel per acre; Canada field peas, ½ bushel; 6 acres. Mixture (2): Skinless barley, 1 bushel per acre; rape, 4 lb.; 5½ acres. Superphosphate applied at the rate of 56 lb. per acre. The barley, wheat, and peas made splendid growth; the rape very fair growth.

These plots carried three horses and three cows for 138 days, and seventeen horses for sixty-six days.

Gilgandra.—Soil, red to grey loam; area, 11 acres; previous crop, summer fodders. Disc-cultivated twice, sown 24th April. Mixture (1): Skinless barley, 40 lb. per acre; Canada field peas, ½ bushel; 5½ acres. Mixture (2): Sunrise oats, 40 lb. per acre, rape 4 lb.; area, 5½ acres. Superphosphate applied at the rate of 56 lb. per acre. The barley and oats made good growth, the peas very fair growth, and the rape fair growth.

These plots carried 105 sheep and six head of cattle for twenty-six days.

Tichborne.—Soil, red loam; area, 10 acres; previous crop, oats, 1920. Ploughed 8th March, spring-tooth cultivated 7th April, sown 11th April. Mixture (1): Hard Federation wheat, 1 bushel per acre; Canadian field peas, ½ bushel; 5 acres. Mixture (2): Skinless barley, 1 bushel per acre; rape, 4 lb.; 5 acres. Superphosphate applied at the rate of 50 lb. per acre. The barley made strong growth (better than the wheat), the peas good growth, but the rape was poor.

These plots carried twenty-two head of horses and cattle for six days, seven head of horses and cattle for twenty days, and fourteen head horses and cattle for seventeen days.

Gregra.—Soil, fairly heavy red loam ; area, 16 acres ; previous crop, wheat, 1920. Ploughed March, disc-cultivated March, sown 30th March. Mixture (1): Clarendon wheat, 50 lb. per acre ; Canada field peas, 25 lb. ; 5 acres Mixture (2): Sunrise oats, 40 lb. per acre ; Canada field peas 25 lb. ; 5 acres. Mixture (3): Skinless barley, 50 lb. per acre ; rape, 3 lb. ; 6 acres. Superphosphate applied at the rate of 56 lb. per acre. The barley made good growth, the oats and wheat very fair growth, and the peas fair growth, but the rape failed to germinate.

These plots carried thirteen head horses and seven cattle for eighty-four days, and thirty sheep for thirty days.

Orange.—Soil, red loam to grey clayey loam ; area, 6½ acres ; previous crop, Sudan grass. Ploughed 4th April, harrowed 15th April, sown 23rd April. Mixture (1): Skinless barley, 1 bushel per acre ; rape, 4 lb. ; 2 acres Mixture (2): Emerald rye, 1 bushel per acre ; Canada field peas, ½ bushel ; 2 acres. Mixture (3): Florence wheat, 1 bushel per acre ; rape, 4 lb. ; 2½ acres. Superphosphate applied at the rate of 56 lb. per acre. The wheat, barley, and rye made good growth, the rape fair growth, and the peas poor growth. Stock did not care for the rye.

These plots carried five horses for six days, six cattle for twenty one days, nine horses for twenty days, sixteen horses for ten days, and 100 sheep and twenty cattle for one day.

Alectown West.—Soil, rather heavy red loam ; area, 12 acres ; previous crop, oats, 1920. Ploughed February, disc-cultivated March, disc-cultivated April, sown 5th May. Mixture (1): Cape barley, 1 bushel per acre ; rape, 4lb. ; 10 acres. Mixture (2): Skinless barley, 1 bushel per acre ; rape, 4 lb. ; 2 acres. Superphosphate applied at the rate of 30 lb. per acre. The Skinless barley made excellent growth, the Cape barley fairly good growth, but the rape was rather poor, being smothered by barley.

The crop was cut for silage and pitted, making 45 tons.

In all cases, when the soil was in a wet condition, the stock were taken out of the paddock. In future wheat will not be grown as a winter fodder crop ; although the growth is satisfactory from a fodder point of view, it does not allow of the crops being changed, and preference will therefore be given to barley and oats. Skinless barley has given the greatest bulk of fodder, and stands grazing well, while oats has much to recommend it as a rotation crop.

When possible, the crops should be sown by the end of February, or the beginning of March, when even more satisfactory results would be obtained than those quoted.

South Coast.

R. N. MAKIN, Inspector of Agriculture.

WINTER green fodder experiments were conducted in co-operation with the following farmers:—

J. R. Knapp, Bolong.
J. Chittick, Kangaroo Valley.
A. L. Bryen, Wetherill Park.
J. H. Martin, Pambula.
E. T. Kelly, Bega.
Manager, Boys' Farm Home, Mittagong.
V. J. Collins, Bemboka.
L. B. Garrad, Milton.
J. Timbs, Albion Park.

The season proved one of the worst experienced for some time, so far as weather conditions were concerned, the plots owned by the last three farmers in the above list being in consequence failures. In some parts very heavy rain fell during April and May—in one instance 1,335 points were registered in April, and 1,231 in May—and such rain was of course too much for March-sown crops. A most noticeable feature, particularly on Illawarra, among winter-grown crops, was the failure of oats. Although germination was satisfactory, this crop failed to grow, and in many cases died right out. This might be accounted for by the ground's loss of heat owing to the heavy, continuous rain, though on higher and drier ground wheat crops for green feed did much better than oats. It has been pointed out before that in order to get the best results in growing winter or any other green fodder crops it is necessary that cultivation paddocks be drained, and until such work is carried out farmers working the stiffer soils particularly will find their crops unprofitable. There is seldom even any attempt made to carry off surface waters, and the loss every year on the South Coast from neglect in this direction is enormous, not only with cereal crops but with others also.

In reviewing the work and comparing the varieties with returns given by them in other years, it will be seen that Thew wheat is still the most reliable, for although it may not yield any astonishing returns it can be depended upon (particularly on the lighter soils) to return a satisfactory crop. Florence and Firbank (both earlier than Thew) maintain their reputation. Canberra, which is comparatively new, promises well, and will be tried again. Hard Federation, which in 1920 yielded better than was expected, must give place to a more suitable variety. It is not suitable for green fodder, as it is not sufficiently early, it rusts badly, and it is shorter in the straw than the varieties before mentioned. It was included in 1920 owing to a shortage of seed of the more suitable coastal wheats.

The results with oats, where conditions were at all favourable, are on a par with those of other years. Sunrise continues to attract attention on account of its early maturity and heavy yields. The figures in the accompanying table do not do justice to this variety, as at the time of cutting in almost every case Algerian was in its prime and Sunrise a good deal on the dry side. Sunrise oats and Grey field peas form a very fine fodder if sown in March to cut in July, though it is a mixture that is more suitable for the stronger soils. In every case Algerian oats were much the latest to mature.

In barleys it was found that Cowra 36 (now known as Trabut) matured a fortnight to three weeks earlier than Cape. As both plots were harvested at the same time, the returns do not do justice to Trabut, as the yield would have been greater had it been harvested when at its best. It can be strongly recommended for growing on good land for early feed.

YIELDS (per acre) of Wheat, Oat, and Barley Varieties for Green Fodder.

Cereal and Variety.	Bolong.				Kangaroo Valley.				Wetherill Park.				Pambula.				Mittagong.				Bega.			
Wheat—	t.	c.	q.	lb.	t.	c.	q.	lb	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.
Thew	6	19	2	6	4	4	3	12	3	0	0	0	5	19	1	4	5	7	2	20	......			
Thew and Peas ..	8	19	0	9	5	17	1	12	5	8	2	8	8	2	3	12	5	0	1	4	......			
Florence .. .	4	17	3	14	5	13	2	4	3	0	0	0	6	14	1	4	5	14	1	4	......			
Firbank .	5	3	1	7	6	2	2	8	3	3	3	20	6	0	0	0	6	17	0	16	......			
Canberra	5	14	0	21	4	0	0	16	3	15	2	24	6	11	1	20	4	5	2	24	......			
Hard Federation .	4	3	1	20	3	6	2	0	2	12	3	12	4	5	2	24	4	2	3	12	.....			
Oats—																								
Sunrise—	7	11	2	4	9	8	2	8	2	1	1	20	13	0	0	0	5	11	1	20	10	11	1	20
Ruakura .. .	5	5	0	0	6	2	2	8	Failed.				14	5	2	24	5	0	0	0	10	17	1	8
Guyra . ..	8	19	0	9	7	11	3	0	1	1	1	20	11	1	1	20	5	11	0	8	11	12	3	12
Algerian	14	6	0	17	6	12	0	0	2	10	0	0	13	12	3	12	4	5	2	24	11	15	2	24
Barley—																								
Cowra, 36	7	15	3	14	4	7	1	4	Failed.				5	14	1	4	2	14	3	0	......			
Cape	8	1	1	7	3	6	2	0	Failed.				7	8	2	8	2	11	1	20	.....			

Upper North Coast.

W. D. KERLE, Inspector of Agriculture.

RESULTS of winter fodder trials for the 1921 season are available from eight centres in the Upper North Coast district. Plots sown in four other localities (Casino, Warrell Creek, Condong, and Camira Creek) were ruined by the floods of May and July. The farmers who successfully co-operated with the Department were:—

E. A. Green, The Risk, Kyogle.
R. W. Hindmarsh, Bellingen, Bellinger River.
M. McBaron, Raleigh, Bellinger River.
Garrett Long, Tatham, Richmond River.
Henry Short, Dorrigo.
F. Allard, Brooklana, Eastern Dorrigo.
S. S. Dawson, Burrapine, Nambucca River.
W. J. Irvine, Uki, Tweed River.

The season was anything but favourable, owing to the excessive winter rains. Early sowing was not possible, and in only a few cases was winter feed actually available. The comparatively heavy rainfall of March and April reached a climax with the flood rains in the middle of May, all the rivers in the district rising to heights approximating the disastrous floods of the early nineties. The result was the inundation of the river flats and considerable loss of crops—winter fodders, late maize, lucerne, &c. June and

July saw a continuance of wet conditions and several minor floods, culminating in that of 23rd and 24th July, which rose several feet higher than the May flood, and caused considerable loss of stock and crops, particularly on the Tweed. Under such conditions the plots under review suffered very severely. In a number of cases, as already stated, they were completely covered and ruined; in others, plots on slightly lower portions or situated where the water remained longest were destroyed, and even where they were planted out of flood reach they suffered from excessive moisture, washing of the soil, and rust. The rainfall was as follows:—

Month.	Bellingen.	Kyogle.	Raleigh.	Tatham.	Dorrigo.	Brooklana	Burrapine.	Uki.
1921.	Points.	Points.	Points.	Points.	Points.	Points.	Points.	Points
April ..	182 from 20th	......	... ..	......	......	.....	......	...
May... ...	2,594	318	......	1,049	......	91 from 28th	....	... ...
June .. .	765	511	765	532	301 from 16th	907	317	...
July... ...	1,642	858	1,642	841	2,716	2,349	1,996	1,426
August ...	136	38	136	150	205	247	77	220
September ..	362	213 to 16th	362	... ..	355	302	260	360
October ..	......	......	75	......	306	316	315	390
November ..	......	......	......	.....	411	......	......	423
Total ...	5,681	1,938	2,980	2,572	4,294	4,212	2,965	2,819

Details of the Plots.

Bellingen.—Soil, alluvial, rich; previous crop, oats. Ploughed three times (31st December, 1920, 16th March and 15th April, 1921); harrowed after each ploughing; seed broadcasted on 19th and 20th April at the rate of two bushels per acre, except the combination crop of wheat and legumes, of which the rate was one and a half and half a bushel respectively. No fertiliser was used. The floods in May and July (which in this locality were the highest for twenty years) covered these plots with the exception of Zealand, Warden, Cleveland, and Canberra, but only remained on six plots long enough to do any damage. It is particularly noteworthy that the wheats Warden and Zealand, which gave the highest yields, are new to the coast and did not show any rust, although with such a superabundance of rain, conditions were favourable to its development. These varieties are approximately the same seasonally as Cleveland, a late maturing variety which invariably yields well on the coast under normal conditions.

Kyogle.—Soil, alluvial, fertile; previous crop, maize. Soil in excellent tilth; sown 4th May by hand and covered by harrow; germination of all plots excellent, and after-growth luxuriant. Flood in May was not experienced at Kyogle, but the flood-rains in July were severe, the excessive rain causing the crop to lodge, and in some cases to rust, particularly Ruakura oats. The growth of vetches was particularly strong, proving too heavy for the Thew wheat. This plot gave the high yield of 13 tons 14 cwt. 2 qrs.

out-yielding all other plots with a margin of 3 tons 11 cwt. 2 qrs. per acre. The high return from Cape barley is noteworthy, and also the yields of Hard Federation and Thew, and the combination plots of wheat and oats with Grey field peas.

Raleigh.—Soil, alluvial loam; previous crop, maize; soil in fair tilth. Ploughed twice, and seed broadcasted 28th May, a fortnight after the May floods. Growth was satisfactory, although the rainfall in June was heavy. The flood in July, when the crop was 12 inches high, completely submerged it for three days; but the growth after this flood was very good, considering the damage to the physical condition of the soil. Rust was bad in the oats but the wheats were practically free. The yields, although comparatively light, were remarkably good in view of the adverse conditions with which the crop had to contend.

Warden Wheat at Bellingen.

Yield, 11 tons 13 cwt. per acre.

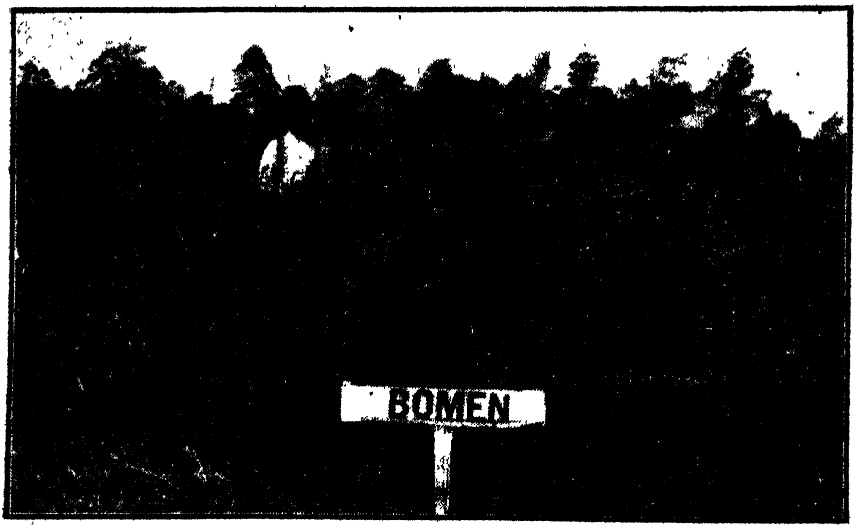
Tatham.—Soil, alluvial loam; previous crop, maize. Ploughed three times. The condition of the soil was excellent, but the rainfall, as elsewhere, was excessive, the flood on 15th May (9·55 inches) causing it to set badly. The floods of 23rd July covered the whole of the experimental area, but did not remain for any length of time, with the exception of the trial of fertilisers with Thew, the oat trial and the Cleveland wheat, which were on a lower lying portion and were completely ruined. The growth of legumes was particularly good at this centre, and accounts for the high yields obtained from Huguenot wheat and peas and Thew and vetches. These plots recovered remarkably after the July flood and the yield of 13 tons 15 cwt. of the former was, under the circumstances, excellent. The growth of legumes in all cases where sown with wheat was too heavy for the cereal, and resulted in a more or less tangled mass of green fodder.

An experiment with Thew wheat and peas to determine the most suitable quantity of wheat to apply with half a bushel of Grey field peas per acre gave the following returns:—

	t.	c.	q.	lb.
Thew wheat, 2 bushels, Grey field peas, ½ bushel ...	10	2	1	8
„ 1 „ „ „ ..	9	18	1	6
„ 1½ „ „ „ ...	9	16	1	20

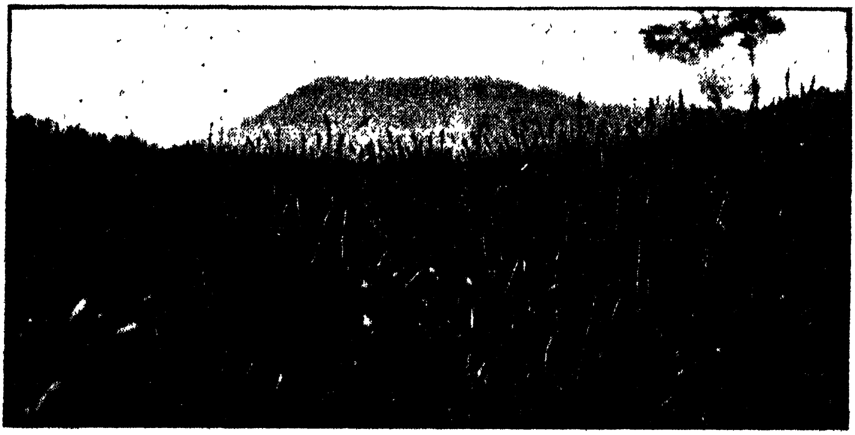
Wheat at Bellingen.

Cleveland (9 tons 5 cwt. 3 qrs.) on the left; Zealand (10 tons 4 cwt. 2 qrs.) on the right.



Bomen Wheat yielded 7 tons of green fodder at Bellingen.

Dorrigo.—Soil, red volcanic light loam; previous crop, potatoes. Ground ploughed once after ploughing out potatoes, and harrowed twice; sown 16th June, earlier sowing being prevented by rain. Heavy rain in July (2,226 points from 22nd to 24th) caused considerable washing of the soil, the site being a rather abrupt hillside, typical of Dorrigo. The yields were also affected by caterpillars, which attacked the leaves and ears, particularly of the oats. Rust was not particularly in evidence this season on the plateau.



Vetches and Thew Wheat at Kyogle.

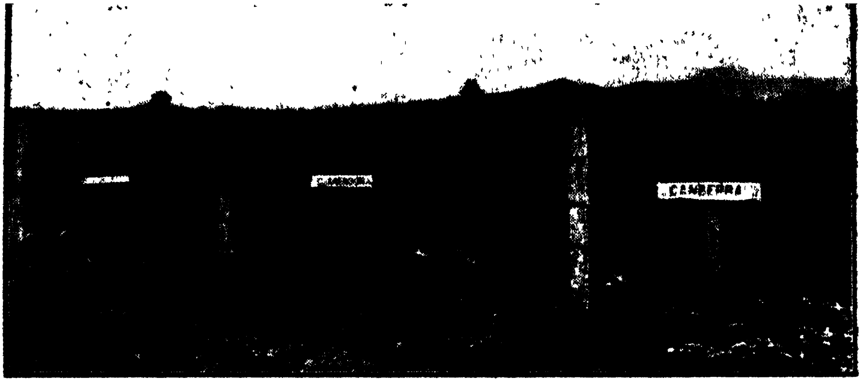
The vetches were too heavy for the wheat, and the crop was a dense tangled mass. Yield, 13 tons 14 cwt. 2 qrs.

Grey Field Peas and Thew Wheat at Kyogle.

Yield, 8 tons 5 cwt. 3 qrs. per acre.

Brooklana.—Light volcanic loam, typical of Eastern Dorrigo plateau; soil in excellent condition; cultivation thorough; previous crop, potatoes, uniformly fertilised. The rainfall (over 42 inches) in the growing period was very heavy, and although flooding was not possible owing to the nature of the country, such a heavy precipitation was detrimental to high yields. Lachlan, a new oat for the coast, showed a considerable amount of smutted ears and rust. A very considerable increase resulted from the use of artificial fertilisers, as is usual in this locality.

Burrapine.—Soil, alluvial loam, fertile; previous crop, maize. The ground received only one ploughing; the tilth was fair. The crop was sown on 14th June. Several attempts were made to sow in autumn but wet conditions prevailed. The excessive rainfall reduced the yields by fifty per cent. The July flood covered the whole crop and was responsible for the failure of nine plots which were on ground slightly lower than the rest of the experiment.



Wheats under Trial at Raleigh.

Firbank, 7 tons 11 cwt. 1 qr.; Clarendon, 7 tons 8 cwt. 2 qrs.; Canberra, 7 tons 2 cwt. 2 qrs.

Uki.—Soil, alluvial loam, typical of the fertile pockets in the upper reaches of the Tweed River. Continuous rain and consequent inability to get on to the ground delayed sowing for some months, the plots being broadcasted on 12th July. The downpour at the end of July, which resulted in the most disastrous flood in the history of the Tweed, played havoc with all crops. The young seedlings in the fodder plots were badly damaged and the soil set, and this reduced the yields considerably.

Summary.

The results of this season's trials are, generally speaking, not consistent with the average of previous years, this owing solely to the excessively wet season. Most of the sowings were made late. It is very seldom, however, that sowings can be made sufficiently early on the coast to provide fodder for winter feed, owing to the heavy rains of late summer and autumn. Spring is usually dry and feed short, hence early sowing is not always advisable. Should fodder not be required for use in spring the weather conditions are more favorable for converting the crop into hay at this time of the year. It would be more fitting, therefore, if these were termed "spring fodders."

Yields (per acre) of Cereals and of Cereal and Legume Mixtures for Green Fodder.

—	Kyogle.				Bellingen.				Tatham.				Raleigh.				Burrapine.				Brooklana.				Dorrigo.				Uki.			
Date of Sowing	4th May.				19th and 20th Apl.				4th and 5th May.				28th May.				14th June.				28th May				16th June.				12th July.			
	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.	t	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.
Thew wheat and vetches..	13	14	2	0	9	10	0	0	11	7	3	12	7	15	2	0	Flooded.				....				8	16	3	0	8	0	1	0
Sunrise oats and Grey field peas	10	3	0	0	....				....				8	12	1	0	,,				....				....				....			
Huguenot wheat and Grey field peas ..	10	0	0	0	9	4	1	4	13	15	0	0	....				,,				....				6	2	0	10	....			
Cape barley	8	10	0	0	Flooded.				....				....				3	19	1	4	....				....				....			
Thew wheat and Grey field peas	8	5	3	0	9	0	0	0	....				9	7	0	0	Flooded.				....				5	17	3	20	8	16	3	0
Hard Federation ...	8	4	2	0	....				....				....				5	15	0	0	....				....				....			
Thew wheat	7	18	1	0	6	8	3	0	7	12	1	0	7	0	3	24	Flooded.				....				5	3	3	12	7	6	2	0
Sunrise oats	6	18	2	0	Flooded.				Flooded.				....				,,				5	15	1	9	7	3	1	20	8	17	3	0
Cleveland wheat ...	6	15	2	12	9	5	3	0	,,				6	0	0	24	5	12	0	0	....				4	18	0	4	6	8	1	0
Algerian oats	6	14	1	8	Flooded.				,,				5	12	3	0	7	14	3	0	4	2	3	0	7	8	2	0	3	5	1	0
Ruakura ,, ...	6	1	2	0	,,				,,				....				4	9	1	0	4	17	1	0	5	17	2	14	3	17	1	0
Black Winter rye ..	5	17	0	16	5	0	1	0	4	12	2	0	....				Flooded				....				....				....			
Warden wheat	5	16	0	0	11	13	0	0	....				....				,,				....				....				....			
Skinless barley	5	3	0	0	Flooded.				....				....				4	8	0	0	....				....				9	10	3	0
Warren wheat	4	13	0	10	,,				7	7	2	12	6	14	0	8	6	5	1	12	....				5	10	1	16	7	8	3	0
Canberra ,, ...	4	12	2	0	7	3	0	0	....				7	2	2	12	5	0	3	24	....				7	0	2	20	....			
Bomen ,, ...	4	8	0	4	7	0	0	0	....				....				8	14	2	10	....				5	9	0	8	5	4	1	0
Firbank ,, ...	4	6	0	22	6	17	0	16	7	1	0	0	7	11	1	20	8	13	3	0	....				6	6	1	12	8	18	2	0
Florence ,, ...	4	4	2	10	6	1	1	20	7	1	3	24	....				9	1	0	0	....				5	8	3	12	7	11	1	0
Clarendon ,, ...	4	2	0	0		8	2	8	7	8	0	0	7	8	2	0	....				....				6	10	2	10	....			
Zealand ,, ...	....				10	4	2	0	....				....				....				....				4	15	0	0	4	5	2	0
Rye and Grey field peas	....				6	15	0	0	....				....				....				....				....				....			
Algerian oats and Grey field peas	....				....				....				6	9	0	0	....				....				....				....			
Guyra oats	....				....				....				....				....				7	19	0	0	6	15	3	0	....			
Lachlan ,, ...	....				....				....				....				....				5	10	3	0	....				....			
Huguenot wheat ...	....				....				....				....				....				....				6	15	0	0	....			

The necessity of providing fodder for dairy cattle in spring, or as a standby in case of a dry spell in early summer, is still largely unappreciated by dairy-farmers on the coast. The value of conserved fodder was shown this season no less than in periods of drought. The inundation of the paddocks and serious loss of grass incurring a big expense in the purchase of hay or chaff or in adjistment. In the majority of cases this could have been avoided if the common-sense principle of fodder conservation had been adopted.

YIELDS in Winter Fodder Fertilizer Trial.

—	Brooklana				Dorrigo.				Raleigh.			
Date of Sowing	28th May.				17th June.				29th May.			
Variety of Crop	Sunrise Oats.				Algerian Oats.				Thew Wheat.			
	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.
No manure	5	15	1	19	6	5	2	0	6	3	1	12
Superphosphate, 1 cwt. per acre..	9	5	1	10	8	13	1	10	6	2	3	16
,, 2 ,, ,, ...	9	10	2	12	7	9	1	20	6	15	1	0
*P7, 2 cwt. per acre	8	9	2	0	7	4	3	0	6	7	2	24
*P8, 2 ,, ,, ...	9	2	2	14	6	17	3	9	6	18	3	2
*M5, 1½ ,, ,, ...	7	0	0	0	8	9	1	4	7	1	1	10

*P7 mixture consists of equal parts of superphosphate and bonedust; P8 of equal parts of superphosphate and blood and bone; M5 of 2 parts superphosphate and 1 part sulphate of ammonia.

Central Coast.

J. M. PITT, Inspector of Agriculture.

On account of the extremely wet season, a number of the winter trials arranged for on the undermentioned farms either could not be sown or were so badly damaged by heavy rains and flood waters that the results were not comparable.

Arrangements for plots were made with the following farmers:—

J. G. Ward, Sherwood, Macleay River.
R. Lindsay, Gladstone, Macleay River.
T. Hoad, Mt. George, Manning River.
J. C. Duff, Mt. George, Manning River.
A. H. Norris, Mt. George, Manning River.
D. Cameron, Mt. George, Manning River.
G. Richardson, Mt. George, Manning River.
R. Richardson, Mondrook, Manning River.
B. Richardson, Dumaresque Island, Manning River.
A. C. McLeod, Tinonee, Manning River.
H. Flett, Taree Estate, Manning River.
A. H. Longworth, Ghinni Ghinni, Manning River.
W. H. Duffy, Comboyne, Manning River.
Alex Smith and Atkins Bros., Bandon Grove, *via* Dungog.
M. Smith, Paterson.
R. Apps, Miller's Forest.

Rarely has a year been marked by such continuous and heavy rainfalls as 1921. The following table will give some idea of what farmers had to contend with during the months of preparation of the seed beds and afterwards. With the probable exception of some of the Mt. George plots and at Bandon Grove, cultural operations were restricted to doing whatever was possible when possible.

RAINFALL.

	Mondrook.	Taree.	Kempsey.	Bandon Grove.
	Points.	Points.	Points.	Points.
March	404	511	286	137
April	958	964	477	428
May	831	870	1,546	464
June	862	803	669	638
July	659	869	943	844
August	57	57	72	27
September ...	332	397	265	...
October	364	480	319	...

Along the Macleay, both plots arranged for were sown, but they were totally destroyed by floods in July. The Manning growers were more fortunate—ten plots being arranged for, nine being sown and four being weighed. The Bandon Grove plot was sown early and had not the amount of rain to contend with and therefore yielded well. The Paterson and Miller's Forest plots were sown late, and the resulting growth made into hay at an average yield of about a ton to the acre. A plot at Miller's Forest sown early in the season was totally destroyed by flood.

The yields with one or two exceptions were not comparable with those of previous years. However, the fodder proved extremely valuable, especially so where the majority of the farmers' pasture paddocks had been covered with deposit.

The results again demonstrated that oats will not thrive during very wet seasons. Sunrise, with the inclusion of vetches and peas, gave good returns at Mt. George, the plots being the best of the oats for the season. Algerian oats gave a fairly good return grown side by side with Sunrise in the same plots, but the majority of sowings of this variety were poor. Its habit of clinging to the ground for some months is certainly a detriment. Cowra No. 25, Cowra No. 22, and Guyra were poor.

Of the wheats, Warren, Huguenot, Clarendon, and Thew were probably the best. It is unfortunate that supplies of Huguenot nowadays are so limited. It is undoubtedly the heaviest yielding variety for coastal conditions, and its staunch habit makes it very suitable for the inclusion of a legume. Farmers on the whole do not bother about the variety they buy, merely relying on an agent, consequently in most cases some poor yielding unsuitable variety is grown. Why they do not take more notice of experiment data, and grow varieties that yield probably twice the amount per acre, seems hard to understand. Clarendon kept up its reputation of being a good rough weather wheat. Currawa and Canberra are both good sorts, carrying plenty of leaf, stooling moderately, and proving themselves well worthy of further trial. The wet season was favourable for the growth of vetches. Peas on the other hand were mostly a failure.

TABLE of Yields.

Varieties.	Mondrook.	G. Richardson, Mt. George.	Tinonee.	A. H. Norris, Mt. George.	Bandon Grove.	Paterson.
Date Sown	End of May.	10 April, 1921.	18 April, 1921.	16 April, 1921.	10 March, 1921.	August, 1921.
Oats—	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.
Cowra 25	......	......	2 17 0	......	......	......
Cowra 22	4 0 0	......	3 11 0	......	8 12 3	......
Cowra 22 and vetches ...	5 11 1	......	......	......	......	......
Sunrise	4 15 3	......	......	10 15 0	......	......
Sunrise and vetches ...	6 11 1	......	6 16 0	12 5 0	......	......
Sunrise and field peas ..	......	12 0 0	4 13 0	...	10 6 1	......
Algerian	5 17 1	......	5 0 0	......	......	......
Algerian and vetches ...	......	......	5 7 0	11 9 0	......	......
Guyra	......	......	......	......	7 3 3	......
Guyra and Peas	......	......	......	......	......	8 0 0
Wheat—						
Huguenot	......	......	6 16 0	......	......	......
Huguenot and Peas ..	6 11 3	......	......	......	......	......
Thew	6 8 2	......	4 14 0	6 14 0	......	6 0 0
Thew and Peas	......	......	......	8 7 0	......	......
Clarendon	6 15 1	......	5 0 0	......	9 15 1	6 0 0
Currawa	6 3 0	......	5 11 0	......	......	......
Canberra	6 0 0	......	......	......	......	......
Warren	7 0 0	......	9 13 0	......	......	......
Zealand	5 0 0	......	......	......	......	......
Firbank	......	9 5 0	......	......	......	7 0 0
Bomen	......	......	4 14 0	7 14 0	......	......

Mr. Apps, at Miller's Forest, made about 1 ton of hay to the acre off several varieties sown during August. Guyra, Sunrise, and Thew were the best.

DISSOLVING ARSENIC IN GLYCERINE.

IN reply to a correspondent who wanted to know how arsenic might be dissolved in glycerine for use in a blow-fly specific, it was stated that arsenic will dissolve in glycerine to some extent. A solution known as arsenic and glycerine standard is used for fixing dyes, such particularly as aniline blue. This is stated to consist of 4 lb. white arsenic dissolved in a gallon of glycerine.

The solubility of arsenic in glycerine is generally stated to be 2 lb. arsenic in the gallon of glycerine, and this—or a little less—is the amount we obtained in trying to make the solution in the laboratory. In this case the glycerine was heated, and ordinarily one would not expect to get a much stronger solution. This quantity of arsenic should not have any injurious effect on sheep, but that is a question that can only be answered by experiment.—F. B. GUTHRIE.

Popular Descriptions of Grasses.

[Continued from Vol. XXXII, page 542.]

E. BREAKWELL, B.A., B.Sc.

The Mitchell, Kangaroo, Native Oat, and Flinders Grasses.

THE Mitchell grasses are confined to Australia, and, from a pastoral standpoint, may be considered one of our greatest national assets.

In the field two of the Mitchell grasses cannot be mistaken, viz., *Astrebla pectinata* and *A. triticoides*. They are characterised by wheat-like husks (glumes) surrounding the seed, the specific name "triticoides" meaning "wheat-like." A third species, however (*A. elymoides*) has an inflorescence somewhat resembling a Danthonia, to which genus the Astreblas are allied.

The Mitchell grasses are amongst the commonest and most valuable grasses of Queensland. In this State they are mostly confined to the North-western and Central-western Slopes and the plains, being practically absent from the Riverina and southern portions of the continent. This bears out the fact that the Mitchell grasses must have good summer rains and congenial winters for their development. Attempts have frequently been made to grow Mitchell grasses at the Botanic Gardens and at Hawkesbury Agricultural College, but the results have been most disappointing, and according to present data these grasses cannot be recommended for the coastal districts or the tablelands.

In Queensland there are at least five distinct varieties of Mitchell grasses, but in this State the number is confined to three—*Astrebla triticoides* (sometimes called Curly Mitchell), *A. pectinata* (Bull Mitchell), and *A. elymoides* (Hoop Mitchell).

Curly and Bull Mitchell are very much alike in habit, both possessing wide succulent leaves and a somewhat similar inflorescence. They are both charaterised by the manner in which they quickly respond to rain, a second growth of leaves being produced almost immediately. They make their best growth in summer and autumn, and are quickly affected by heavy frosts. Experiments carried out at Nyngan indicate that the seed germinates best when sown in October, and that shallow sowing is better than deep. They are very rapid growers under congenial conditions, the period of growth from sowing until flowering being only a few weeks.

Astrebla elymoides is called Hoop Mitchell, owing to the long, curvy character of the leaves and stems, which are much longer and narrower than those of the other Astreblas, and also harsh in texture. Nevertheless, it is a nutritious grass, and more likely to stand heavy stocking than the other two varieties.

Unfortunately Mitchell grass seed is very dear (10s. per lb.), and no pastoralist can afford to buy it and apply a heavy seeding, but a pound of seed per acre scattered over suitable areas would be very beneficial. This

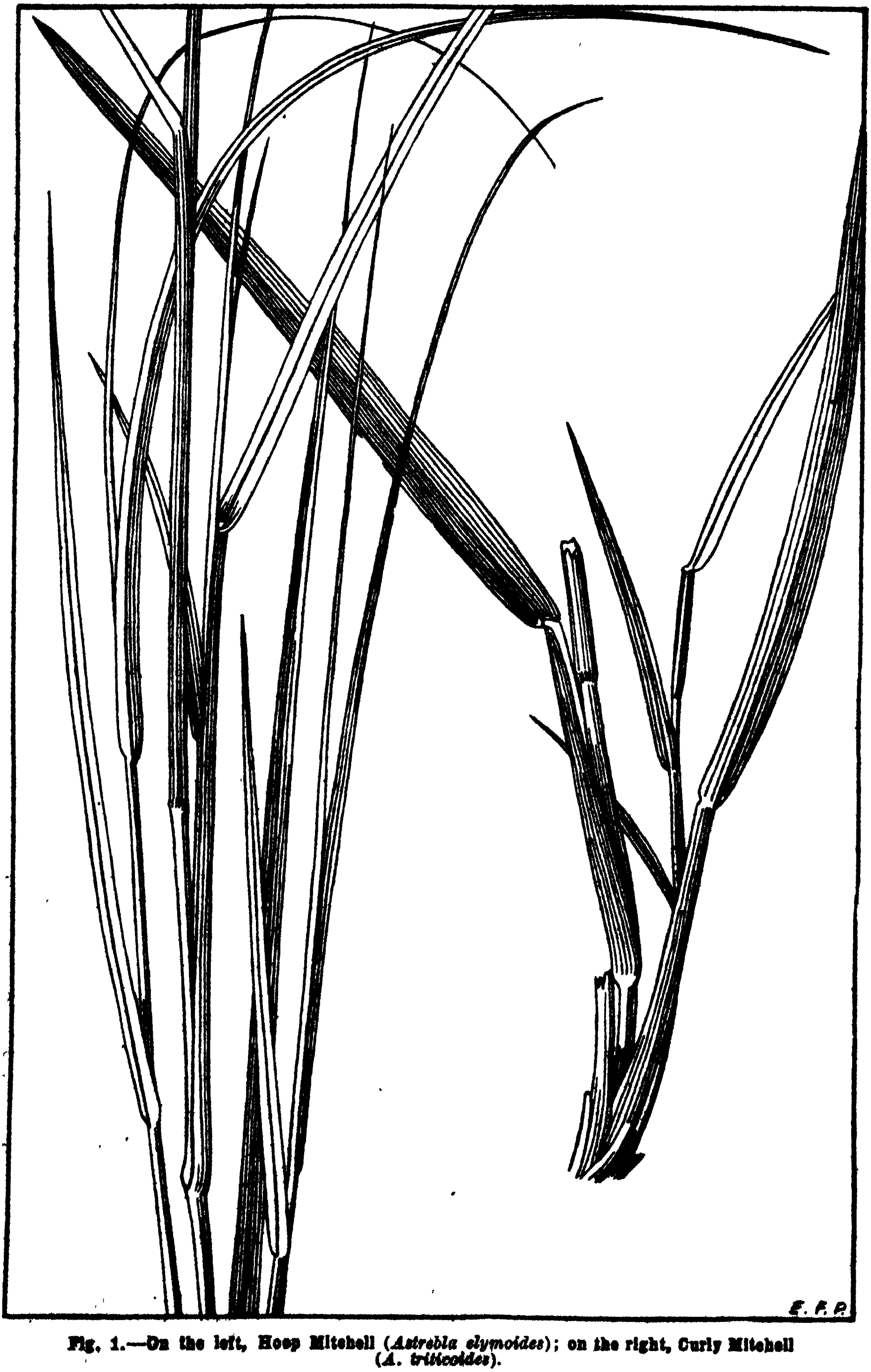


Fig. 1.—On the left, Hoop Mitchell (*Astrebla elymoides*); on the right, Curly Mitchell (*A. triticoides*).

Observe the difference between the leaf systems.

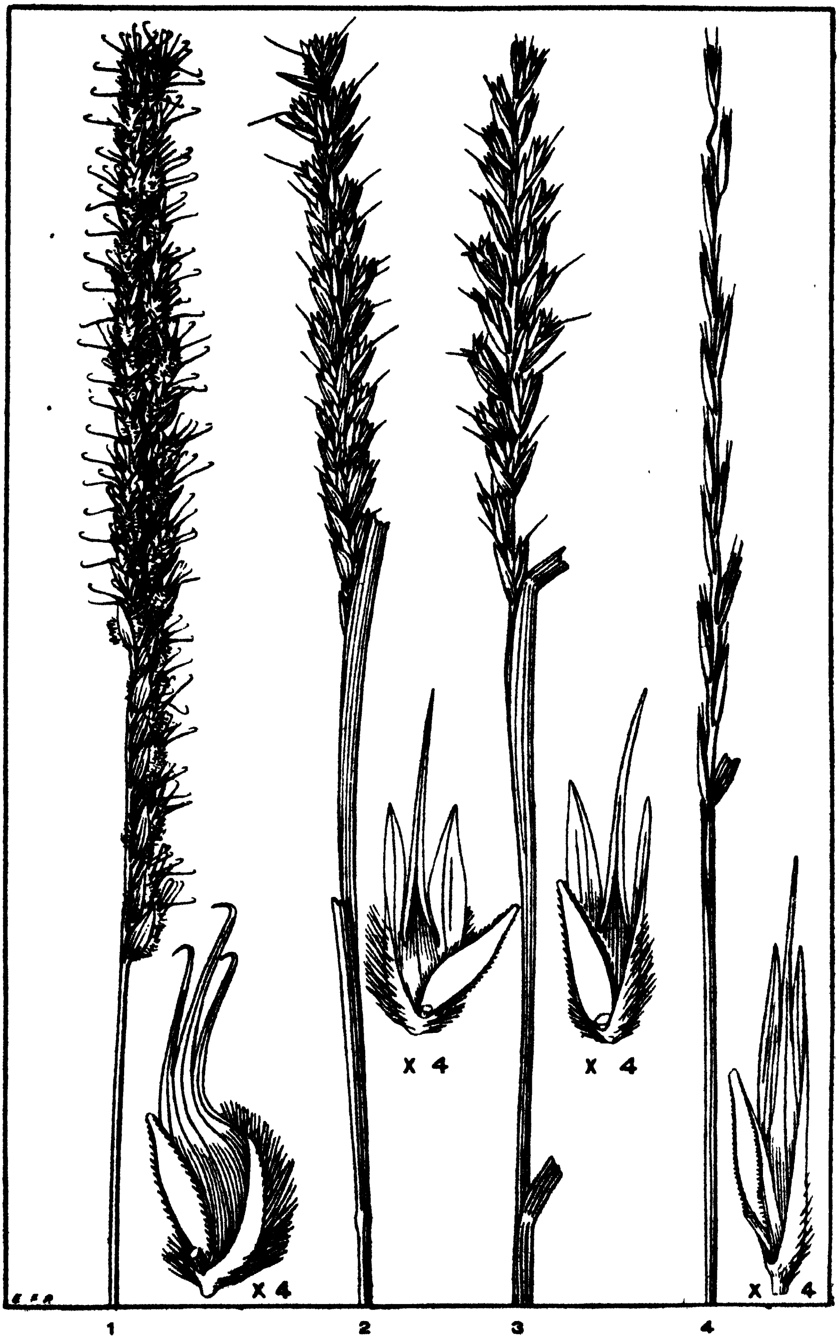


Fig. 2.—Heads of Mitchell Grasses.
Nos. 1 and 2, types of Curly Mitchell (*Astrebla triticoides*); No. 3, Bull Mitchell (*A. pectinata*); No- 4, Hoop Mitchell (*A. elymoides*).

could be done in wet weather, and stock turned on to tramp the seed in as much as possible. Pastoralists who already have a quantity of this grass would be well advised to harvest their own seed and extend the area. By allowing it to seed at periodical intervals its permanence is assured. This is well shown by the fine Mitchell grass paddocks on portion of the North-western Plain.

Kangaroo Grasses.—These are the best known of all our native grasses. They are mentioned in the records of many of our early explorers, but unfortunately the days when the grass "could be tied over the horses' saddles" have practically disappeared. At the present time the kangaroo grass of the west is mostly confined to lightly-stocked or enclosed areas, and has disappeared entirely from thousands of acres of country which once grew it abundantly.

The kangaroo grasses, of which there are several varieties, are erect, leafy branching grasses, and are all characterised by the clusters of spikelets arranged along the flowering stalks. Many of these spikelets are male or barren in character, but there is usually one fertile one in the cluster. The grain, however, often fails to mature, and this undoubtedly accounts for the grass so quickly disappearing under heavy stocking, very few seedlings appearing in the pastured paddocks.

The kangaroo grasses of the west appear to differ considerably in palatability and nutritive qualities from those of the coast and tablelands. The brown colour, also, of the flowering stalk and inflorescence is much more intensified in the western varieties.

The kangaroo grasses of the tablelands are not considered of good quality. They are coarse for sheep, serve as a breeding-ground for worms, and provide no feed in the winter months. It has been proved at Glen Innes Experiment Farm that coarse kangaroo grass pastures are much better ploughed up and laid down to introduced grasses. They thereby carry more stock and maintain them in better condition.

In the western districts, however, the kangaroo grasses are very valuable indeed, both sheep and cattle fattening on them very quickly. Where the grass is abundant the paddock should be shut up at intervals, and the root system allowed to recover. The kangaroo grass of the west makes excellent hay.

In the coastal districts the kangaroo grass often occurs on poor, partly brushed country, and in such situations provides good rough feed for large stock.

Native Oat Grass belongs to the same genus (*Thelmeda* or *Anthistiria*) as the kangaroo grasses, but may be distinguished by the clustered spikelets being fewer in number, and arranged on stalks instead of being sessile, as in the kangaroo grasses. The fertile spikelet has an oat-like appearance, and the stems of the plants have a silky, hairy, or woolly base.

Native oat grass is found in New South Wales, Queensland, Central, Northern, and Western Australia. In this State there is still a good deal of it on the Liverpool Plains, but elsewhere it is not nearly as abundant as previously.

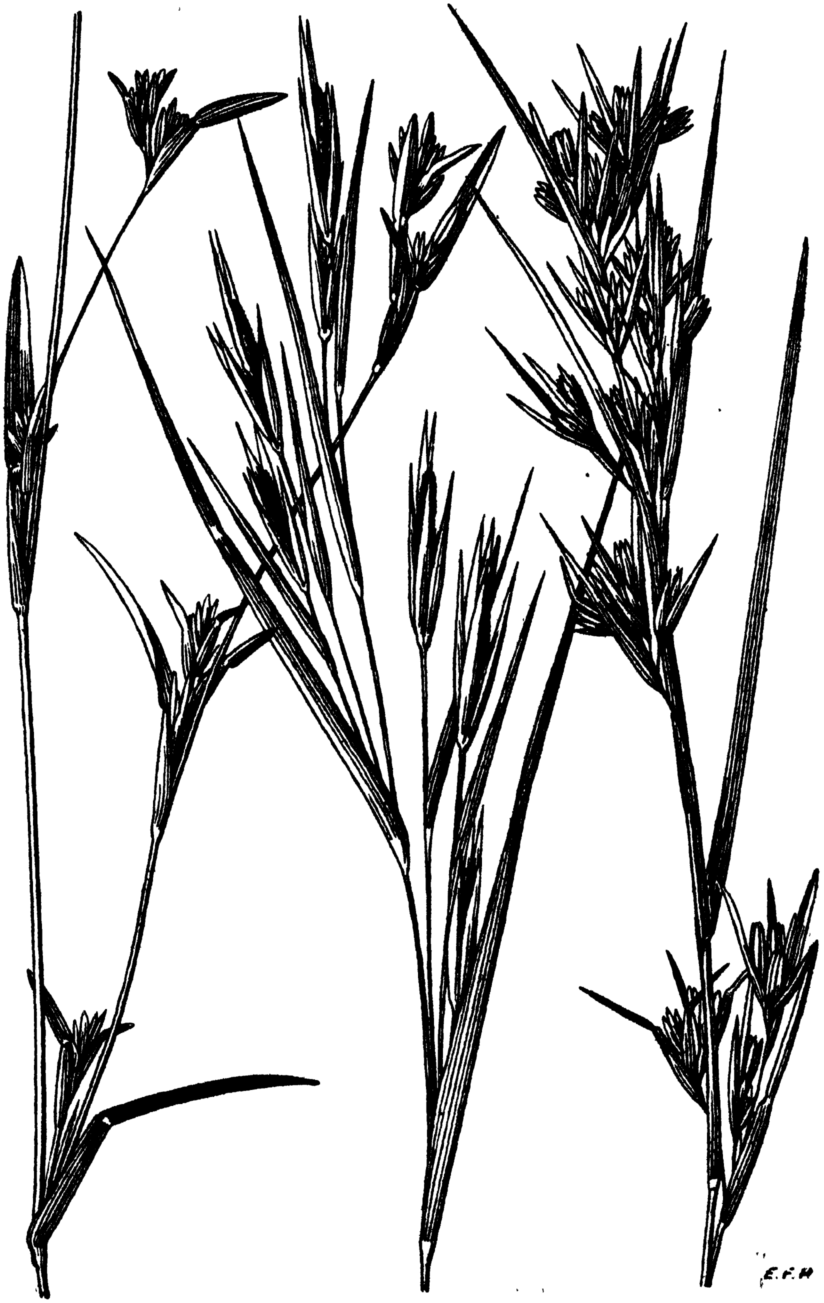


Fig. 3.—Flowering Habit of three Grasses.

On the left, Flinders grass (*Anthistiria membranacea*); in the middle, Native Oat grass (*A. avenacea*); on the right, Kangaroo grass (*A. ciliata*).

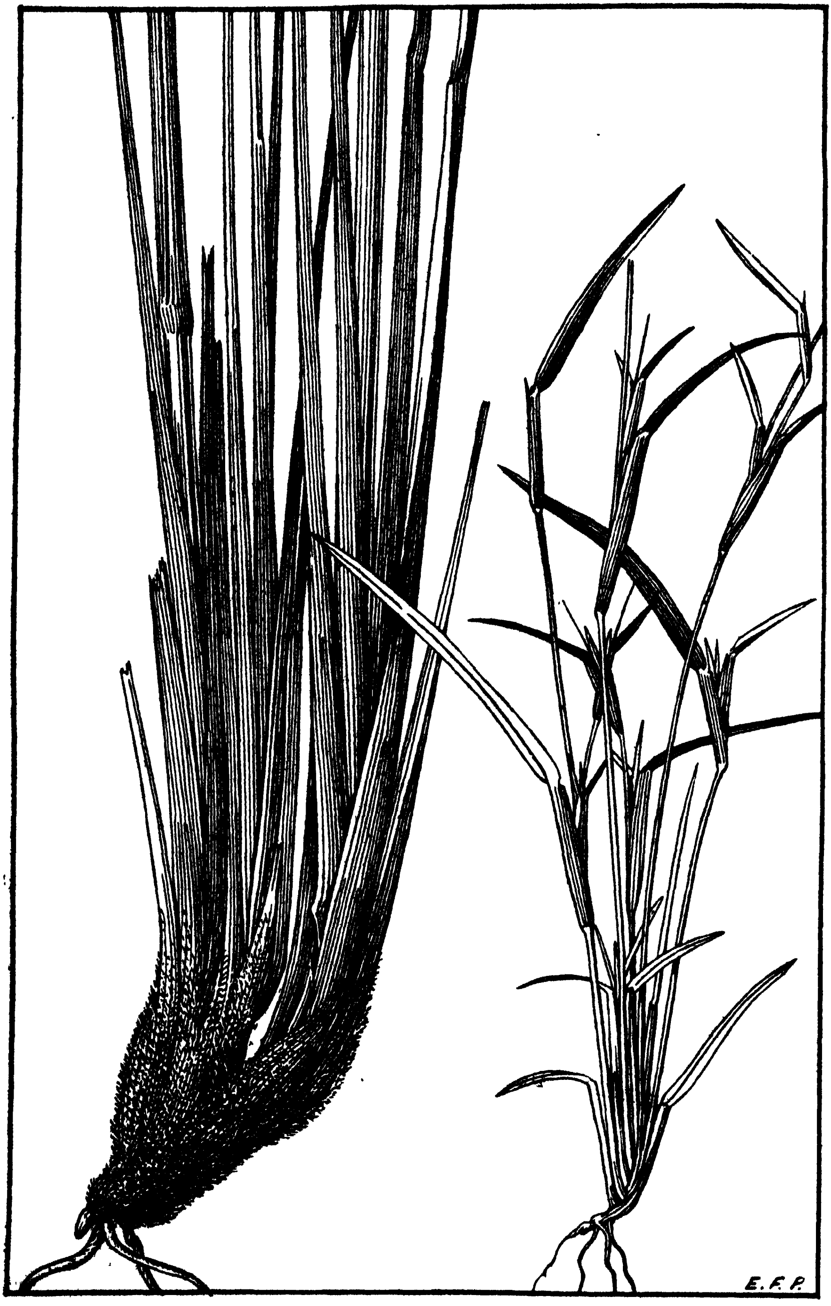


Fig. 4.—On the left, Native Oat grass (*Anthistiria avenacea*); on the right, Flinders grass (*A. membranacea*).

Note the vigorous drought-resistant base of the Native Oat grass compared with the weak annual character of Flinders

The leaf growth is very long, coarse, and dense. It and the stem portion are very nutritious, but more adapted for large stock.

The grass does very well under cultivation, and at Hawkesbury Agricultural College reaches a height of 7 to 8 feet in a good season.

Flinders Grass is also closely allied to the kangaroo grasses. It is, however, distinguished by its much smaller growth, more succulent leaves and stems, and by the pedicellate spikelets.

Flinders grass is very common in Queensland, and receives its common name from the river in that State. In New South Wales it is found in the north-western and western districts, but is never abundant. It can be considered equal in palatability and nutriment to any grass known. Its fattening qualities are proverbial, and pastoralists have a fine asset if they possess any quantity of this grass. It makes excellent hay, and even the mature and dried stalks and leaves are relished by sheep.

The grass sets seed in much greater abundance than either kangaroo or native oat grass, and advantage should be taken of this, and the grass propagated as much as possible by scattering the seed over the areas.

VINEYARD NOTES FOR MARCH.

PRIOR to the beginning of the year the prospects of a good vintage in all districts were bright, but during the month of January abnormally humid weather was experienced in the Hunter River district. The result of these conditions has been a development of downy mildew, which spread very rapidly, causing much injury to the vineyards that have been left unsprayed, and consequently altering the prospects considerably. In the Hunter River district it is the first generally bad experience they have had with this disease, and it is to be hoped that the practical lesson will induce all growers to take the disease seriously and to spray efficiently in the future.

The Mudgee district has also had its first serious visitation, but fortunately for the growers it has occurred late in the season. It should be understood that now downy mildew is in Australia it has come to stay, and the only successful way of growing grapes commercially is to attend to spraying thoroughly, and to look upon it as one of the essential operations of the vineyard.—H. L. MANUEL, Viticultural Expert.

YOUNG CABBAGE PLANTS AND "MOTH."

HAVE you any knowledge of a dip to destroy the diamond-backed cabbage moth after plants are taken from the seed-bed before transplanting?

The Entomologists' reply was to the effect that all young cabbage plants, whether purchased or taken from the seed-bed, should be washed in a weak kerosene solution to kill the eggs and larvæ of the moth, and then washed in clean water to get the oil off them.

After planting—while they are still quite small—the cabbage moth can be kept away by dusting the plants in the early morning with lime and tobacco dust—one of tobacco to four of lime.

Effect of Rations Low in Lime on the Offspring of Cattle.

GERALD F. FINLAY, B.V.Sc., M.Sc., Walter and Eliza Hall Fellow in Veterinary Science, University of Sydney.

Of the mineral constituents of the body, none is of more importance than calcium. In the formation of bone it is especially important. The inorganic material in bone makes up about 40 per cent. of the dry residue, including the marrow, and if the marrow is removed it makes up about 60 per cent. The mineral salts are chiefly calcium phosphate and carbonate, with a little magnesium phosphate, the proportion being as follows:—

Calc. phosphate	85 per cent.
Calc. carbonate	10 „
Mag. phosphate	1.5 „

The calcium salts in the bones seem to be in equilibrium with the same salts in the blood. When the calcium content of the latter fails, the former are called on to make up the deficiency.

The calcium metabolism of the bones is going on all the time, and there is evidence that the calcium has a true chemical union with the other bone tissues, and is not merely deposited as a precipitate. The diseases of bone known as osteomalacia and " rickets " are associated with irregularities in the calcium metabolism. Calcium plays a part in activating certain enzymes and in blood coagulation, and it also plays an important, but as yet unknown role, in addition to bone formation, in fœtal development.

In the lactating animal the calcium metabolism is of special importance. Milk must contain all the substances necessary for the early development of the young mammal, and bone development is one of the most important phases of this development. Hence milk, as one would expect, contains an ample supply of calcium in the form of neutral calcium phosphate. In the case of the cow this causes a great drain on the calcium content of the body, so much so that the bones have to be drawn on to make up the supply. In a heavy milking animal it is impossible for it to keep up the amount of calcium required through the food supply, so that during the period of lactation there is a progressive diminution in the amount of calcium in the bones. Normally this deficiency is made up during the " dry " period, so that the cow commences each lactation period with an ample supply.

So much has been written to show the great importance of the calcium salts in the normal physiological processes of the body. We may now consider the effect of rations low in lime on the offspring of cattle.

Ordinarily the calcium requirements of the body are supplied by the calcium which is in organic combination in plants. Calcium is present in all feeds, but the form in which it occurs seems to be of some importance. The question whether the calcium must be in organic combination, or whether the addition of inorganic calcium salts to a ration otherwise deficient in this respect is sufficient for requirements, is of very great practical importance. With herbivora which have received only straw as the source of roughage, when inorganic calcium has been added to the ration, a great improvement has been seen in the offspring as compared with a previous offspring.

In metabolism experiments with rats it has been established that the common cereals do not contain sufficient mineral matter for proper growth and reproduction. Calcium, sodium, and chlorine—so necessary to the animal—are deficient in the cereals. Common salt serves as an efficient source of the two latter, but calcium, the most important mineral requirement, is not made available in so simple a manner to many animals. Feeding experiments with rats showed that inorganic calcium, in the form of calcium phosphate, calcium carbonate, calcium sulphate, or even the very insoluble calcium silicate, all served as very efficient sources of this mineral. To ascertain the degree to which this holds good in other animals requires further investigation.

The straw of wheat and oats that is so frequently the only source of roughage is also deficient in calcium, so that the question as to the result of feeding only grain and straw, and the means that may be adopted to combat the trouble that ensues, becomes one of very great importance to the farmer.

The question has been investigated at the Wisconsin Experiment Station. Cows fed on a ration of oat grain and oat straw gave premature birth to dead or weakling calves. The same thing happened when wheat grain and straw formed the ration, only in this case the ill-effects were even more apparent. The addition of the growth-promoting fat-soluble vitamine failed to remedy the defects. Likewise, the addition of casein, which by itself can supply protein requirements, did not cause improvement. It was evident that there was some toxic material present, or some mineral deficiency which accounted for these results. As sodium chloride was always available, that possibility was ruled out.

Maize grain and maize stover fed gave good results, the calves being well developed at birth. The maize grain was then fed, using wheat straw as the roughage, but the harmful results continued, thus indicating that the straw was at fault. When to this ration a proper mineral mixture was added normal reproduction occurred.

A ration of wheat grain, wheat straw, and a proper mineral mixture, however, gave the bad results, indicating a second harmful property located in the wheat grain. Further experiments showed that there is evidently a toxic matter commonly associated with the wheat kernel. It is evident that this factor only produces harmful results when wheat forms the greater part of the concentrates of the ration.

As regards the mineral deficiency proved to exist in the straw, analysis shows that frequently there is an amount equal to that in maize stover, which gave good results. It would appear that the mineral matter in the former is not in such an available form as in the latter.

Oats were found to act in a somewhat similar manner to wheat. A cow fed on whole oats and oat straw produced a 53-lb. dead calf, while an addition of 2 lb. of calcium acetate to each 100 lb. of grain resulted in the production of a normal calf weighing 73 lb. The oat grain has not the toxic properties of wheat. Other experiments of a similar nature showed that the oat plant by itself is not an efficient diet, the offspring being born prematurely, and either dead or very weak at birth.

To find out whether it was a calcium deficiency alone, various methods of supplying calcium were tried. In most of these experiments sodium chloride was available, so that possibility did not hold here. Calcium acetate, calcium carbonate, wood ashes, and rock phosphate were all tried, and each succeeded in making up the deficiency. It was thus apparent that both wheat and oat straw were deficient in the available amount of calcium required for normal reprodution. Further experiments showed that maize stover, silage, and especially legume hay, when fed as roughage, supply the necessary amount of calcium.

It is thus apparent that one of the most important phases of practical feeding is to be certain that the ration fed to cows contains an ample supply of lime. When wheat or oat straw is fed as roughage it should only form a portion of the roughage allowance, and should be supplemented by good legume hay. When this is impossible a suitable calcium mixture should be added.

It is apparent that lime has an important function, beyond that of formation of bone, in the physiological processes of the growing animal.

"THE AUSTRALASIAN FRUITGROWERS' ANNUAL AND TRADE RECORD."

THE first issue of the above—dated for the year 1922—consists of 144 pages, well illustrated, and contains articles of moment to fruitgrowers and all interested in the trade.

In addition to useful cultural and statistical information, there is a simple but complete book-keeping system with specimen entries, which will enable every reader to keep a record of every transaction. The columns have been designed to suit the requirements of the income tax authorities, and there are simple explanations of many details running over several pages.

The cultural articles have been carefully prepared with the co-operation of a number of Government experts, and are a valuable feature.

Our copy from the publishers, 9 Queen-street, Melbourne.

Hygiene in the Piggery.

THE MAIN FACTOR IN THE PREVENTION OF DISEASE

[Continued from page 103.]

W. L. HINDMARSH, B.V.Sc., M.R.C.V.S., D.V.H.

The Cost of Bad Housing.

CONTRARY to a prevalent impression, good housing costs very much less than bad—in the long run. Diseases due to bad housing are catarrh of the head, pneumonia, and rheumatism. Where these diseases occur they can usually be traced to one or more of the following causes:—(1) Insufficient shelter and draughty housing; (2) damp flooring; (3) badly drained yards and pastures; (4) overheating through crowding in small sties and subsequent chill; or (5) infection from previous cases of pneumonia.

Pneumonia, commonly called "pants" by the farmer, owing to the exaggerated action of the ribs and abdominal muscles, is a common complaint among our pigs. In addition to this symptom, the pig has a high temperature, is off his food, seeks a quiet, dark spot to lie in, and is not easily roused. There may also be coughing and a discharge from the eyes and nose. Sometimes the disease will occur very suddenly, with few or none of the above symptoms, and the animal will die within a few days. Young pigs are most affected, but the disease may attack animals of any age.

The danger of this disease is that it tends to become infectious and spread through the herd, causing many deaths. Pigs bought from infected piggeries will introduce the disease into healthy stock. Treatment is rarely of much benefit, although often pigs recover; but the recovered pigs are usually unthrifty, do not grow nor put on fat, and often suffer afterwards from nervous disorders. It is rarely profitable to try and fatten a pig that has suffered at all severely from pneumonia. All affected pigs should be immediately removed from the healthy, so that the disease shall not be spread. Prevention consists in paying attention to the housing and sanitation of the pigs' quarters.

Rheumatism is a disease characterised by lameness in one or more legs, swollen, painful joints, and sometimes by partial paralysis of the limbs. The provision of warm, dry housing and well drained yards is the only preventive measure; while the addition of a little Epsom salts and saltpetre to the food will often cause improvement in sick animals.

Heat apoplexy is a disease of pigs which is due to insufficient shelter and shade in hot weather. It occurs in very fat animals, and is most likely to be noticed if the pigs are exercised or travelled in the heat of the day; but it may often be seen in pigs without exercise if they are exposed to the hot sun without shade. There may be few warning signs, the fat pig simply falling over and becoming unconscious. The condition is serious. Water poured over the head and snout will often be beneficial. Whisky or brandy in doses of a dessert to a tablespoonful may be given, or any other stimulant which is available. Prevention lies in providing shade in the hot weather, and not travelling or trucking fat pigs on excessively hot days.

The Penalty of Improper Feeding.

Diseases due to improper feeding include a large group of conditions, which may be roughly classified as—(1) those diseases causing derangement of the digestive organs, and (2) those diseases characterised by lack of development of various body structures.

In the case of (1) the symptoms noted may include any of the following:—(*a*) Scouring; (*b*) constipation; (*c*) unthriftiness; (*d*) lack of appetite; (*e*) depraved appetite; (*f*) excessive thirst; (*g*) tucked-up belly and signs of pain; and (*h*) "thumps"—a spasmodic contraction of the diaphragm and abdomen, giving the appearance of exaggerated "hiccoughs." These conditions may be remedied by attention to the directions already given as to correct and cleanly feeding. When the pig first appears sick he should be given a dose of 1 to 3 ounces of castor oil and ½ to 1 teaspoonful of turpentine. When this has acted the pig should have milk and such easily digested food until recovery takes place.

The condition most commonly experienced under the heading of those characterised by lack of development of various body structures is that known as "rickets." This disease is due to the lack of lime, salts, and phosphorus in the food. The animal is a "bad doer," has weak, soft bones, enlarged joints, and may be lame or even paralysed. Often the young pigs are pot-bellied, scour frequently, lick walls and fences, and chew all kinds of indigestible substances, and may show nervous troubles, such as convulsions. This disease is made much more severe if the animals are kept in dark, damp houses. The following mixture, added to the food at the rate of one dessertspoonful daily per adult pig, gives the best results in the treatment of this trouble:—Sterilised bone meal, 20 parts; sulphate of iron, 1 part; common salt, 40 parts. This is of especial value when added to the brood sow's ration.

It is to be remembered that the deficiency of any necessary constituent in the food may set up symptoms of various classes, and care should be taken that too much of any highly concentrated feeding stuff will cause trouble. Similarly, if a lot of watery, sloppy food is given without sufficient solids, the pig will not be thrifty. The vicious habit of eating the young which occurs in sows may often be traced to incorrect feeding.

The water supplied to pigs should be as clean and pure as possible. One of the objections to the filthy hog wallows so commonly seen is that the animals drink the water, into which is drained all the filth and infection that may be in the yard. Care should be taken that the water is not contaminated with the dung and excreta of other pigs or farm stock. Attention has already been drawn to the possibility of infection from other piggeries by streams that have flowed through properties higher up.

Parasitic Diseases.

These diseases constitute such conditions of ill-health as are brought about by infestation of the animal's body with parasites, the parasites most commonly encountered being lice and worms.

The fact that in all parts of the State lice are so prevalent on pigs shows how little the farmer is alive to the danger of these parasites. Their presence on the animal causes unthriftiness and slow fattening, while the constant irritation of the skin and falling off in condition are sources of continual loss. Often, owing to the scratching and rubbing, inflammatory and necrotic processes are set up. It has also been stated on good authority that such infectious diseases as swine fever may be transferred by these insects. The lice may be easily killed by the application of a 2 per cent. solution of any common coal tar disinfectant, such as lysol or cresol. Fat and kerosene (one part of kerosene to fifteen parts fat) is also effective, and good results are obtained from kerosene emulsion made up of kerosene 2 gallons, hard soap 1 lb., and water 8 gallons, 1 gallon of this solution being added to 9 gallons of water for dipping. Treatment must be carried out at seven-day intervals for three dippings to be effective, and the pigs must not be exposed to the sun after treatment, or scalding may result. The houses and posts where the pig has been rubbing must also be sprayed with a 5 per cent. solution of disinfectant to kill the lice which have left the pig after feeding.

Parasitic worms may be found in (1) the stomach and intestines, or (2) in the fat surrounding the kidney. The former may be responsible for diarrhœa, unthriftiness, and even more serious conditions, sometimes resulting in the animal's death, while to the latter are ascribed many of the cases of paralysis of the hindquarters which are by no means uncommon in all parts of the State. Medicinal treatment, comprising the use of such drugs as sulphate of iron, oil of turpentine, and areca nut, is often beneficial, and may cause the expulsion of the parasites, but it is far more profitable to prevent infection than to cure it. The eggs of most worms are passed out in the excreta, and must be swallowed by the animal before they can develop to the mature form. Hence attention to cleanliness in feeding, the prevention of the soiling of the food and feeding troughs with dung and urine, and the draining and filling in of muddy pools in the pig-yards will in a large measure control the spread of parasitic troubles.

Infectious Diseases.

The infectious diseases liable to cause loss in New South Wales are swine fever, tuberculosis, and infectious pneumonia. Tuberculosis has been discussed recently in this *Gazette*. It is mainly caused by using milk from tuberculous cows, although it is spread also by the presence of infected pigs in the sties. Swine fever is liable to cause great losses if ever the infection should become rife. The symptoms vary in this condition, sometimes the signs of lung disease being most marked, at other times digestive troubles and obstinate scouring being predominant. When a farmer is losing a large number of pigs, some dying suddenly and others lingering for three or four weeks, and especially if this occurs shortly after the introduction of new stock, he should suspect some such contagious disease, and report the matter to the local inspector of stock.

By attention to sanitation and hygiene, and by the isolation for three weeks of all pigs newly introduced, the farmer could minimise his losses from these diseases. Swine fever is extremely contagious, and once brought into a piggery spreads with alarming rapidity. The infection remains for a long time in damp, dark sties, and is very difficult to eradicate. Hence in the prevention of this, as of other pig troubles, the farmer can safeguard himself from much loss and trouble by attending to the general hygiene and management of his stock.

THE CRUX OF THE MARKETING QUESTION.

How to prevent alternate starving and flooding of the farmers' markets is a problem which no individual middleman can solve. It is far beyond the power and ability of individual, private, or co-operative middlemen. The surplus product which floods the market and depresses prices is neither owned nor handled by one or a few companies. It is divided among great numbers of middlemen each of whom sells when he thinks that the market affords him the best price. Because there is little, if any, co-ordination among these widely scattered, disconnected units, too many of the farmers' products reach the market in too short a time.

The surplus which causes the flooding of the markets is not caused by any one farmer alone but by all the farmers producing a given product. Each contributes but a small part to the total seasonal surplus for the industry. This, therefore, is not a local and individual problem but a country-wide group problem. The only way to hold this surplus back so that prices will be stabilised is to have all or most of the farmers of the industry organised for orderly marketing. The resulting stabilised prices work to the advantage not only of producers and consumers but of the mass of middlemen as well.—"The Road to Better Marketing," Circular 136, College of Agriculture, University of Wisconsin.

RATS IN THE GARDEN AND ORCHARD.

IT is not difficult to poison or trap rats infesting a house where all food can be closed up, but in fields where they are attacking field crops and fruit, it is a much more difficult matter.

Traps may be put out baited with cheese and cooked meat, and sprinkled with oil of aniseed, the scent of which has a great attraction for these rodents. Strychnine dusted over sliced carrots is used to kill garden rats in the United States, but, of course, extreme care must be taken where such poisons are used.

Fruit trees with clear stems and no branches touching the ground can be protected with large bands similar to those used on the ropes of a ship.—W. W. FROGGATT, Government Entomologist.

Feeding and Contact Experiments with St. John's Wort.

MAX HENRY, M.R.C.V.S., B.V.Sc., Government Veterinary Surgeon.

In the issue of the *Agricultural Gazette* for April, 1920, Sydney Dodd, F.R.C.V.S., D.V.Sc., records the results of certain feeding experiments with St. John's wort, which indicated that by sensitisation of the skin the plant rendered the skin peculiarly susceptible to the action of the sun's rays, and that intense irritation was suffered by the affected animal in consequence. For a description of the symptoms observed in natural and experimental cases the reader is referred to Dr. Dodd's report.

It was noted that two points of some importance remained undetermined—(1) the effect of feeding the plant in a younger stage than that used by Dodd, and (2) the effect of continued contact of the plant with the skin.

As an opportunity was offered, it was decided to test these points, using both cattle and sheep as experimental animals. Unfortunately, it was not possible to commence while the plant was in a very young stage, but the feeding was commenced and the symptoms observed while the plant was somewhat younger than appears to have been the case with the material used by Dodd—that is, it had not commenced to flower.

The feeding experiment was commenced at 4 p.m. on 12th October, 1921. Two steers, one red and white and one a light roan with much white on it, and two shorn sheep were placed in a small paddock almost entirely overgrown with St. John's wort. There was, in addition, a little grass and herbage, but not sufficient even partly to maintain the animals. There was a dam of water in one corner, and practically no shelter of any kind.

During the intervals between my visits Mr. Whyte, Stock Inspector, of Mudgee, watched the animals and reported thereon. Both steers were hungry when placed in the paddock, and ate ravenously at the wort.

On 14th October the red and white steer appeared to be rather inflamed about the eyes, and showed much switching of the tail.

On the 15th, 11 a.m., both animals lying down and quiet.

On 16th, 3 p.m., red steer rather restless.

On 17th, 2 p.m., red steer lying down near the edge of the dam looking very sick; raw patches on white parts on top of the rump from "licking" itself. The roan steer appeared very restless, with much switching of the tail. It was reported that the cattle had been racing round the paddock as though mad, and the red and white one was seen to run into the dam.

Both sheep so far showed no ill-effects.

Up to this the weather had been changeable, overcast, with showers, and cold frosty nights; no nice sunny days.

When seen on 20th October the skin lesions were well marked, and had evidently been in existence for some days. The red steer was distinctly depressed, and remained lying down near the dam most of the time. It presented areas of unpigmented skin on the loins, flanks, shoulders, and legs, and on all there was some evidence of excoriation, but this was most marked on the loins and flanks. The roan steer was very restless. Tail constantly switching, wandering from one part of the field to the other, licking at loins, flanks, and back. There was marked evidence of intense irritation, with excoriations on the flanks and loins.

The sheep on examination showed a very marked reddening of the legs on all parts not covered by the wool, particularly about the hocks. The ears were somewhat thickened, and partly covered with dry crusts following excoriation. Around the eyes and between the eye and nostril the hair had been rubbed off and the skin was reddened; in parts small wounds had been made, which were scabbed over. The nostrils showed several dry crusts covering raw areas. During the heat of the day the sheep made towards the dam, and tried to bury their noses in the moist earth on the edge.

None of the above lesions had been present on the stock when placed in the paddock, and all, especially the steers, had lost considerably in condition since being put on the St. John's wort.

As the results obtained coincided so exactly with those produced by Dodd in his experiments, it was not held necessary to carry the feeding further, and the stock were removed.

It may be noted that results were obtained more rapidly than in Dodd's cases. This may be due to two factors—(1) the stock had no shelter from the sun's rays, and (2) they were feeding on the living plant, whereas Dodd's material must have been cut at least twenty-four hours before being fed.

It was noted that as the heat of the day came on the restlessness became more marked.

The contact experiment was commenced on 29th October, when two white steers (specially chosen as having fine, unpigmented skins) were turned into the paddock, where they were later joined by two sheep. All these animals were muzzled during the day, while they were running in the St. John's wort paddock, but at night they were removed from the paddock and placed in a small yard, muzzles removed, and a feed of lucerne given to them. No signs of ill-health or skin irritation were observed. The two steers were kept under the above conditions for twenty days, and maintained their condition well.

The plant during this period came into full flower, and as it was about 2 feet high, and the steers were small, contact was established not only on the legs and face, but on the body. The sides of the steers were yellow with the pollen from the flowers.

Of the sheep, one died as a result of an accident the day after it was put in, and in order to keep the other sheep quiet one of those animals which had become affected during the feeding experiment was muzzled and placed in the paddock. These sheep were kept under the above conditions for fourteen days. The animal which had not been subjected to the feeding test showed no indication whatever of irritation, nor was any reddening or other change of the skin observed. The sheep which had become affected through feeding rapidly recovered, although it was exposed all day to contact with the plant. The ears, eyes, and upper face were not protected at all by the muzzle, and yet the condition cleared up, the skin became a healthy pink, scabs and crusts fell off, and hair on face and legs commenced to grow again.

Three weeks after removal from the paddock containing St. John's wort the two steers affected through the feeding were examined. Both were again putting on condition, and the skin lesions on the roan had completely cleared up. The red and white steer still exhibited areas on the unpigmented skin covered with scabs, but these were drying and falling off, leaving clean, healthy tissue. No evidence of irritation was noted.

These experiments would indicate that contact alone will not produce skin lesions or irritation, and that the plant at a younger stage than that used by Dodd will produce identical conditions to those reported by him.

The effect of the plant in hay and of the very young green shoots have yet to be worked out.

ANNUAL STUD PIG SALE AT THE HAWKESBURY AGRICULTURAL COLLEGE.

THE Annual Stud Pig Sale at Hawkesbury Agricultural College will be held on Wednesday, 5th April, at 12·30 p.m., when fifty specially selected pedigreed pigs (including Berkshires, Tamworths, Middle Yorkshires, and Poland Chinas) will be sold at auction.

A train is timed to leave Central Station, Sydney, for Richmond, at 8·56 a.m., and vehicles will meet the train and convey buyers to the sale. Luncheon will be provided at the College, and buyers can return to the city by train leaving Richmond at 4 p.m. the same day.

Arrangements can be made for crating and despatching the animals, and the vendors will feed and attend to same pending despatch for only a nominal fee.

Catalogues and further particulars can be obtained from Messrs. Badgery Bros. (auctioneers) and the Principal of the College.

THE MARKET FOR GARLIC.

THE extensive cultivation of garlic is not recommended, unless an assured market has first been secured, and this can only be done by getting in touch with buyers, and growing on a contract basis. Manufacturers of sauce are consumers of this product, and it would be wise to communicate with an interested firm direct. One Sydney firm was prepared to pay £24 per ton, f.o.r., Sydney, and would have taken 12 or 15 tons, with delivery in parcels spreading over January, February, and March. They anticipated larger requirements in future years, and stipulated the small red variety.—A. H. E. McDONALD, Chief Inspector of Agriculture.

Orchard Experiments.

SPRAYING TRIALS AT BATHURST EXPERIMENT FARM.

W. J. ALLEN.

THE spraying experiments carried out during 1920-21 at this farm under the direction of Mr. G. A. Meier, orchardist, were of the following nature:—

1. Experiments in the control of black spot of apple, incidentally the effects of the treatments on powdery mildew to be observed (plots A, B, C, D, E, F, K, L, M, N, and P).
2. Experiments to determine whether lime-sulphur containing such sediment as would pass through the strainer is as effective as the clear liquid racked off (plot G).
3. Experiments to determine whether lime-sulphur stored in bunged casks for different periods is as effective as freshly-made lime-sulphur.

The Black Spot Experiments.

These experiments were designed (*a*) to compare the efficacy of lime-sulphur, Bordeaux mixture, Burgundy mixture, and a proprietary substitute for lime-sulphur as controls; (*b*) to ascertain, if possible, at what stage of growth it is best to apply the first spring spray to check the disease; and (*c*) to ascertain the strength of the first spring spray necessary to check the disease.

Owing to the absence of black spot no comment is possible as to (*a*), the comparative efficacy of the different sprays. As to the point (*b*) there seems very little hope of arriving at any precise conclusion so far as those districts are concerned where the spring weather conditions are very variable. Concerning (*c*), observation of the effect of the sprays on the foliage and fruit showed that lime-sulphur applied at either spur-bursting or pinking stage scalded the tips and sometimes the edges of the first of the first young leaves that surround the blossom clusters. This scalding has been repeatedly demonstrated in similar experiments with lime-sulphur, but the damage is too slight to check the growth of the fruit noticeably. When lime-sulphur was applied at spur-bursting strength, when 50 per cent. of the blossoms were in full bloom, this scalding of the leaf was greater. The petals of the open blossoms were also browned, but the ensuing crop was not appreciably reduced. Spraying when fruit trees are in blossom has given variable results, and on present data it would appear to be unwise to spray at this period unless the earlier application has been omitted and the disease is making headway. Bordeaux mixture and Burgundy mixture caused severe russeting, and also retarded the growth of the fruit. The proprietary substitute for lime-sulphur, used at 12 lb. to 50 gallons water at spur-bursting stage, and 3 lb. to 50 gallons water combined with each lead arsenate spray, gave the same results as lime-sulphur diluted according to the table in the departmental lime-sulphur pamphlet and applied at similar periods. As there was no outbreak of black spot no opinion can be expressed as to the comparative efficacy of the proprietary article as an agent for control of the disease.

Effect of Vavious Sprays on Powdery Mildew.

Contrary to the results obtained at the Glen Innes orchard, lime-sulphur as applied for black spot of apple (that is, applied at spur-bursting or at pinking stage and again combined with each of the three lead arsenate sprays), gave just as effective control over mildew as atomic sulphur. As already mentioned, the proprietary substitute for lime-sulphur acted similarly. Bordeaux and Burgundy mixtures, however, gave only very slight control over mildew.

Atomic sulphur gave good control over powdery mildew at this orchard, but did not show any superiority over lime-sulphur, as it did in trials at Glen Innes. A proprietary brand of concentrated nicotine solution was tested as a control for woolly aphis with good results.

The Lime-sulphur Experiments.

Lime-sulphur, with only such sediment removed as would not pass through the strainer, gave exactly the same results as that obtained by allowing the concentrated solution to settle and using only the clear liquid.

Lime-sulphur stored for twelve months in a closed cask did not show quite such effective control over apple mildew as that freshly made. Lime-sulphur stored for two months in a closed cask showed the same results as that freshly made. In the absence of black spot, this result, of course, affords no information as to the comparative efficacy of the two sprays agent for control of the disease.

SPRAYING Trials at Bathurst Experiment Farm Orchard, 1920-21.

Plot.	Treatment	Results and Remarks
A	Sprayed with lime-sulphur at spur bursting strength, first when 50 to 75 per cent. of spurs were bursting, again at pinking stage; then three times subsequently at summer strength for apples and pears, combined with arsenate of lead.	Powdery mildew kept well in check. No burning worth mentioning, except that tips of first leaves around the blossom buds were slightly affected, but no damage was caused. There was no outbreak of black spot.
B	Sprayed with lime-sulphur at pinking strength for deciduous trees other than apples and pears. Same periods as in A.	Same as in A.
C	Sprayed with lime-sulphur at spur bursting strength at pinking stage. Three later applications as in A with lead combined.	Same as in A.
D	Same as in A but omitting spray at pinking stage.	Same as in A.
E	Sprayed with lime-sulphur, first spray as in A, second spray when the centre blossom of the cluster was fully opened, then same as in A.	Same as in A.

SPRAYING Trials at Bathurst Experiment Farm—*continued.*

Plot.	Treatment.	Results and Remarks.
F	Sprayed with lime sulphur at spur bursting strength, first when 50 per cent. of the buds were in full bloom, then same as in A.	Slightly more burning of the leaves, but no damage caused. The blossom petals were browned. The trees carried a good crop of nice clean fruit.
G	Sprayed with lime-sulphur with only such sediment removed as would not pass through the strainer. Same strength and same applications as in A.	Same as in A.
H	Sprayed with lime-sulphur that had been kept in casks, bunged directly after making and kept for 12 months. Same strength and same applications as in A.	The trees did not appears to be so robust as in A, slightly more mildew, but fruit was clean.
I	Same as H, except that spray had been stored for only two months.	Same as in A.
J	Check row. Sprayed with arsenate of lead only at regulation periods.	No outbreak of black spot. Powdery mildew not very bad this season.
K	Sprayed with Bordeaux mixture (6-4-40). First application at pinking and three later applications (6-4-50) combined with arsenate of lead.	Fruit badly russeted and growth of fruit retarded. Very little control over mildew. Trees had a very miserable appearance.
L	Sprayed with Bordeaux mixture (6-4-50) at the pinking stage, followed by three later applications (6-4-60) combined with arsenate of lead.	Fruit badly russeted, especially Granny Smith and Cleopatra. Practically no control over mildew, which was not very prevalent in the orchard last season.
M	Same as in K, but copper soda (6-8-40) used and three later applications (4-8-50) combined with arsenate of lead.	Same as in K.
N	Sprayed with Bordeaux (6-4-50) at the pinking stage.	Same as in L.
O	Sprayed with atomic-sulphur (14 lb. to 100 gallons water was used).	Same as in A.
P	Sprayed with atomic-sulphur, 16 lb. to 100 gallons water. First application at pinking stage and three later applications (14 lb. to 100 gallons water) combined with arsenate of lead.	Same as in A.
Q	Sprayed with crystals and proprietary substitute for lime-sulphur (12 lb. to 50 gallons water) when buds were bursting; then with three later applications at the rate of 3 lb. to 50 gallons water at same periods as three later applications in A.	Powdery mildew kept in check just as well as by lime-sulphur.
R	Check row. Sprayed with arsenate of lead and soap at regulation periods.	No outbreak of black spot. Powdery mildew not very bad this season.

The varieties of apple Dunn, Granny Smith, Jonathan, London Pippin, Rome Beauty' and Stone Pippin, were used on each plot.

Cheesemaking on the Farm.

[Concluded from page 112.]

J. G. McMILLAN, M.B.D.F.A., N.D.D.

Leicester Cheese.

THIS, as its name implies, is a cheese that owes its origin to the county of Leicester. It is rather short in texture, due to special treatment in manufacture, but when properly made is of delicious flavour. Being of a soft nature care has to be exercised in its transport. It is also made flat, so that it will keep in good shape, and generally in weights ranging from 25 to 30 lb. The writer has frequently made Leicesters in this country successfully, and can recommend its manufacture where good milk can be obtained, particularly in the colder weather.

Mixed milk or one milking can be used, a small amount of starter is added—not more than a pint to each 100 gallons of milk, so that the acidity will not be above ·18 to ·19 per cent., or 22 to 23 second rennet test. The temperature of the milk is brought to 84 deg. Fah. As this cheese is highly coloured, annatto extract is added at the rate of 1 drachm to every 4 gallons of milk, and thoroughly mixed throughout at least ten minutes before the rennet is added. When the milk has attained the proper degree of acidity rennet is added at the rate of 4 oz. per 100 gallons. In three-quarters of an hour the curd should be fit to cut.

Cutting is done twice with each knife and the curd then stirred with the hands. The whey at this stage should show about ·12 per cent. acid. The heat is gradually raised to 90 or 92 deg. Fah. in twenty to twenty-five minutes, and is stirred meanwhile with the rake until the small pieces fail to stick together when a number are slightly pressed in the hand. When once the curd draws ⅛ inch on the hot iron the whey should be immediately drawn, and when put on the cooler should be in granular form; it should be stirred for about ten minutes and packed about 4 inches deep, and then covered over. When matted together (in about twenty minutes) cut the curd into blocks about 4 inches square and turn every twenty minutes until fit to mill. When ¾-inch fine threads can be drawn on the iron the curd is milled twice, then salt is immediately added at the rate of 1 oz. to every 3½ lb. curd and thoroughly mixed throughout. After salting the curd should be spread out to cool—down to 70 or 75 deg. Fah. if possible—when it is hooped. The whey at this stage should not show more than ·5 per cent. acidity. Pressure must be gradually applied and for the first hour only the weight of the screw. At the end of three or four hours the pressure may be increased to 5 cwt., and in six hours to 15 cwt. at most. The usual procedure for giving the cheese a good appearance is observed. Mature in a fairly cool room with a temperature not above 65 deg. Fah. In three to four weeks these cheeses are matured. The yield is about 1 lb. from 9 lb. milk.

Brick Cheese.

This cheese is so named because of its shape; it originated in America, where it is very popular. It is a cheese that is slightly open in texture, owing to the small amount of acid developed in its manufacture, but the flavour is mild. Owing to its shape and the care with which it is packed it is a cheese that should become popular in Australia, and because of the ease with which it may be cut into small weights it should appeal to grocers. For the person who owns a few cows its manufacture should be profitable, for little plant is required.

Mixed milk can be used, and the acidity should be about ·19 to ·20 per cent. A small quantity of good starter may be added at the rate of 1 pint per 100 gallons milk. Colour if desired may be added. The milk is raised to a temperature of 86 deg. Fah., and rennet is added at the rate of 1 drachm to each 3½ gallons of milk. The rennet is stirred throughout for about five minutes, and the surface of the milk agitated to keep down fat until milk shows signs of thickening. When the curd is firm enough (in about forty minutes from the time the rennet is added) it is cut—once with the horizontal knife, and lengthways and crossways with the vertical one. Stirring is now commenced and heat applied. The temperature of cooking is 108 to 112 deg. Fah., and cooking should be completed in from forty to forty-five minutes. Watch the curd carefully for acidity; when the whey shows ·16 to ·17 per cent. acidity, and the curd is fairly firm, the whey must be drawn off. The curd is stirred on the bottom of vat to assist in the removal of any surplus whey and is not allowed to mat together. The moulds, which should have been previously prepared for receiving the curd, are made of wood, preferably of red pine, which does not warp. They should be well made, the ends being dovetailed into the sides or well bound, rectangular in shape and without bottom or top, and should measure about 10 to 11 inches long by 5 inches wide and 8 inches deep, slits being sawn on the inside to assist in the escape of the whey. Before use new moulds should be thoroughly boiled in soda water to take out any taint.

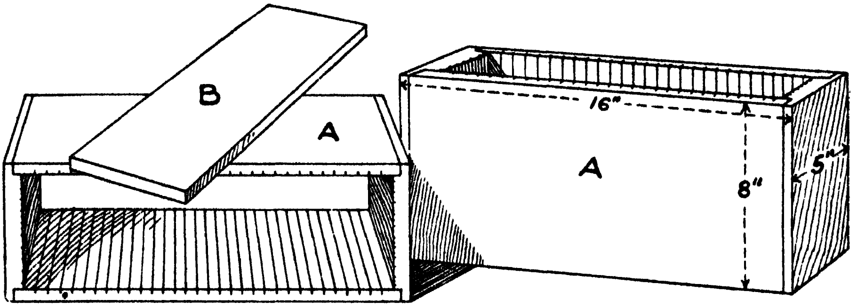


Fig. 34.—The Mould used for making "Brick" Cheese.

The writer has found it beneficial to put a cloth in each mould—plain muslin will do. All the moulds are set on a table and the curd is placed in each and well pressed with the hand. Fill each mould right up with as nearly an equal quantity in each as possible; then place one part of the cloth over the top surface and on this place the wooden follower, which should be of such a size as to slide downwards in the mould easily (thus preventing the formation of a rim on the cheese). On the top of the follower is placed a clean brick.

In an hour's time turn the cheese in the mould and put on two bricks for pressure; this turning should be done frequently during the twenty-four hours the cheese is pressing. The morning after manufacture the cheeses are taken out of the moulds and examined for cracks; if any are present the cheese should be scraped with an old saw which will allow of all holes being filled. The cheeses are then pressed again, and after a few hours the cloths are removed (and washed for use on later lots), and the cheeses salted by rubbing a little salt all over each side. The salt dissolves and penetrates to the centre of the cheese. Salting is done for three or four days, and in this country it has been found advantageous to keep the cheese in the moulds during the salting period, this keeping them in better shape. This, of course, means extra moulds, but as the cheese when pressed only fills about half of the mould two cheeses can be put in the one whilst being salted. After salting the cheeses are placed in the curing-room at a temperature of about 60 to 65 deg. Fah. They should be turned daily for the first week and kept clean by washing if necessary. Brick cheeses are ripe at about six weeks.

Port du Salut Cheese.

This is a popular French cheese. Perfectly sweet milk is taken and heated to 88 to 90 deg. Fah., and rennet is added at the rate of 1 drachm to 4 gallons milk. In about an hour the curd is cut with a long knife into pieces about 1 inch square, when the bucket or can containing the curd is set in hot water and brought up to a temperature of 104 deg. Fah. The curd is stirred meanwhile, and, when once it attains a rubbery consistency it is taken from the whey and placed in a mould lined with a cloth. The mould is round and made of tins with perforations at intervals of about 3 inches; the diameter of the mould is 8 inches, and its depth 6 inches. Once the curd is filled in, the cloth is drawn over and the wooden follower inserted. On this is placed a weight of about 20 lb., and in an hour's time the cheese is turned. Next morning and for the three subsequent days the surface of the cheese is rubbed with salt. At the end of the second day it can be removed from the mould and placed in the curing-room. Port du Salut is ripe in about six weeks and should be cured in a cellar with a fair amount of humidity.

Pont l'Evique Cheese.

This is another French cheese that is very popular. Perfectly sweet milk is used, direct from the cow. The temperature is brought down to 92 deg. Fah., and 1 drachm of rennet is added to every 3 gallons of milk, which is stirred for three minutes. In about forty-five minutes the curd will be fit to cut. This is first done with an ordinary table-knife into 2-inch squares. The curd is now lifted into cloths with a sharp ladle. This cloth is best spread over a wooden frame set on a rack in a square or rectangular vat about 6 inches deep, so that the whey can be collected. The ladling should be done carefully, so as not to break the curd into small particles, thus causing the cheese to be too dry. The cloth is gradually tightened up to assist in removal of the whey.

When only a small quantity of cheese is being made, obtain an ordinary flat milk dish, set a strainer in it or arrange two pieces of wood to form a frame, put the cloth over this and ladle into each cloth about 1½ gallons; then, by drawing the ends together and tying, the whey is gradually expelled. The cloths are tightened about every fifteen minutes, and in about two and a half hours the curd should be ready to put in moulds.

The moulds can be either oblong or square in shape—in fact, there is no reason why they may not be round. Oblong moulds are generally used, and these are 6 inches long, 3¾ inches broad and 2¼ inches deep, and have neither top nor bottom. Properly speaking, the moulds when filling should be placed on straw mats. In this country, however, this kind of mat cannot be obtained. Lacking this, the best way is to have a piece of flat tin large enough to hold six moulds and perforated to allow the escape of the whey. On this tin place a piece of coarse cloth and lay the moulds on close together. Now break the curd up and fill up the moulds level with the top. When filling always put the driest pieces of curd in the centre—this allows of better drainage and a cheese with smoother surface; a slight pressure is applied with the fingers whilst filling the moulds. When all the moulds are filled, place a piece of coarse cloth over the top and on this another piece of strong perforated tinned steel; place the left hand firmly on this tin and the right hand under the bottom tin, and with a quick action turn them over. In about ten minutes the moulds should be turned again, and during the next three or four hours the cheese should be turned hourly. On the following day the cheeses are salted by being rubbed all over with about ½ oz. of salt to each cheese. They should be turned twice daily, fresh dry cloths being used at each turning; just prior to salting it is advisable to scrape the cheeses (the sides particularly) with a knife so as to fill up any cracks.

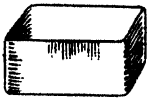


Fig. 35.—Mould for Pont l'Evique Cheese.

On the second or third day the cheese should be quite firm enough to be taken from the moulds. They are then removed to a room with a temperature of as near 60 deg. Fah. as possible, and in three or four days a white mould will begin to appear. If it can be done it is advisable after this to remove the cheeses to a cellar, but if this is not possible an ice chest will do for small quantities, provided that it is not allowed to become too cold. The cheeses can be packed fairly close together, thus minimising evaporation, and should be turned daily. In about three to four weeks the cheese is fit for consumption.

A properly ripened Pont l'Evique is like a ripe pear to the touch. If at all greasy or liquified on the surface it is a sign of insufficient drying or too low temperatures; if dry or leathery it is a sign of too rapid drainage of the curd. The outward appearance of a Pont l'Evique is generally not attractive to the eye of the Australian, but the dark colour is only a film and can be cut off. The writer is of the opinion that once these cheeses are put on the market, provided they are well made, there will soon be a big demand for them. To attain success with soft cheeses, cleanliness is most essential, boiling water being liberally used.

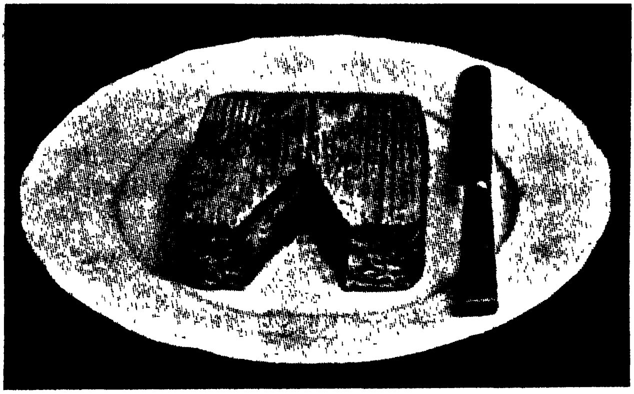


Fig. 86 —A ripened Pont l'Evique Cheese.

Gervais Cheese.

This is a cheese that is made from half milk and half cream; if the cream is very rich in butter-fat the mixture may be two parts of milk to one or cream. The milk and cream are thoroughly mixed together and brought to a temperature of 60 to 65 deg. Fah., and in this climate it is of course necessary (in the summer months at least) to have ice for lowering the temperature to this extent. To 3 quarts of the mixture in a bucket add about 8 drops of rennet diluted in pure cold water, stirring throughout for about ten minutes. Cover the bucket over with a cloth and place it on a wooden shelf. In about twelve to fifteen hours the curd will be formed, so that if the rennet be added to the mixture, say, about 6 p.m., the curd will be ready at a convenient time next morning; further, the night air being cooler than the air during the day, the chances of producing a better article are greater. When firm enough the curd is ladled into a huckaback cloth, large enough to hold 3 quarts, this cloth being spread over a strainer or framework while the curd is being put in. When the ladling is completed the ends of the cloth are drawn together and a piece of strong string in a noose placed around. The bundle is then hung up in such a position that the whey will drain into a bucket.

When the drainage has slackened the cloth is opened and the curd that has hardened on the cloth scraped down with a tablespoon. This is done frequently until the curd is sufficiently firm, which generally occupies about twelve hours. The moulds for Gervais may be either square or round, but they are usually round. Round moulds should be 2¼ inches in diameter and 1⅞ inches deep. To fill the moulds obtain a piece of board about a foot square, cover this with a piece of coarse cloth, place the moulds thereon, and line with strips of blotting paper. Fill the curd in with a spoon, pressing it firmly, smooth the top of each cheese off, put over the lot first a piece of coarse cloth, and then a board, and turn over. In about twelve hours the cheeses can be taken out of the moulds, and for household use can be kept in an ice chest. They can be used almost immediately, but can safely be kept for three weeks, when they have a distinctive cheese taste. In making Gervais cheese in this country the writer has found it beneficial to pasteurise the mixture and subsequently to cool it prior to renneting.

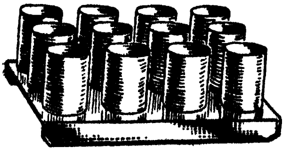


Fig. 37.—Moulds for Gervais Cheese.

In the making of Gervais cheese cleanliness and fairly low temperatures are imperative.

Sour-Milk Cheese.

The housewife often finds that milk goes sour, but it need not be wasted, for it can be utilised in the making of sour-milk cheese. If it is not thick, add a few drops of rennet (if in a clot there is no need to add the rennet). Pour the thick milk carefully into a huckaback towel, tie the ends of the cloth together, and hang up so as to allow the whey to drain off. When the curd is dry it should be passed through a mincer along with a small quantity of ripened cheese. Salt is then added to taste, and also a little pepper and mustard, and the whole is then passed through the mincer again, and finally put into a jar, which is made air-tight. The cheese will be ready for consumption in about two weeks, and can either be used in the ordinary way or in the making of savouries, such as macaroni and cheese.

There are many other soft cheeses, but as these often give off a strong aroma that does not appeal to the average Australian the writer has refrained from dealing with them. To the person with a few cows the making of Caerphilly, Port du Salut, and Brick cheese is specially recommended, and to the man with only one or two, Port du Salut, Pont l'Evique, or Gervais cheesemaking should be an economical proposition.

There is a market for peppermint oil in this State, but buyers will not quote without a sample. The prices at present ruling with wholesale chemists range from 105s. per lb. for the best known make down to 39s. per lb. for the lower grades—an improvement of 100 per cent. over the prices last quoted in the *Agricultural Gazette*.—A. H. E. McDonald.

Cottage Landscape Gardening.

[Concluded from page 141.]

E. N. WARD, Superintendent, Botanic Gardens, Sydney.

THE piece of ground dealt with in this article actually exists at Clifton Gardens, Sydney. In its natural state there were outcrops of rock all over it. The front of the house faces west. The slope is from east to west in the front, and just the opposite at the back, so that the house is built partly on a ridge. The floor of the house is 18 inches above the York paving at the front, and 12 feet above the border marked 10 at the back. A more awkward piece of ground could not be imagined from a landscape-gardener's point of view, for careful consideration has to be given to the fixing of the levels, so that there will be sufficient material for such building up as is required. In dealing with a piece of ground of this description, considerable thought is necessary to ensure that there will be no need to cart material either in or out. A striking feature of the garden now described is the absence of any grass. The owner wanted a garden without the work of mowing lawns and trimming grass edges. The thought of a thick coat of grass in January waiting to be mown, he declared was like a nightmare to him, so in the plan submitted, grass was omitted altogether.

A good substitute for grass in the garden is the York paving already mentioned. This form of garden pavement is easily made from irregular pieces of flagstone or the sawn stone pieces available at all dimension stone quarries. The stones may be of different thicknesses and sizes, but are so laid as to provide a fairly level surface. The intervening spaces are then filled with cement to prevent weeds from growing. Although the edges of such paving must follow a given line, they should appear careless and irregular, not neatly defined like other edgings, so that they can be furnished with creeping plants or tufty subjects. Even the terraced drying ground, marked 20, looks neat and clean with a bed of viola pansies, primroses, and any dwarf growth that will not interfere with the hanging of clothes. The level of this terrace was secured by combing the natural rock outcrop under the house.

A complete series of drawn sections would give a more accurate idea of the falls of the ground, but the steps in the paving show where the grade is too steep to have been otherwise maintained. It will be borne in mind, too, that the sill of the front is the lowest part of the ground at the front, and the part marked 15 the lowest at the back.

Parts 3, which are level, are designed for a herb garden, in the middle of which should be a sun-dial, rain-guage, or statuette. The edges of the paving could be furnished with variegated thyme, behind which could be grown clumps of rosemary, lavender, horehound, mint, pennyroyal, rue, sage, tansy, balm, taragan, parsley, horseradish, and fennel—all of time-honoured use for either toilet, medicinal, culinary, or other household purposes.

No. 1 denotes York paving. The material for these paths is obtained from the waste of stone sawmills or worn-out flag paving, sometimes at the disposal of municipal and shire councils. A fair sample of this kind of paving is to be seen in the Japanese garden in the Sydney Botanic Gardens, just north of the refreshment rooms. It is everlasting, requiring no periodical re-gravelling or tarring and sanding, and is certainly ornamental. Suitable plants for the edges of the paths are Sedums, Echeveria, Campanula mauritanicus, Heria procumbens, Lithospermum prostratum, Allysun, Sagina, Calocephalus Browni, daisies, lobelias, freesias, violets, and violas.

No. 2, the next important feature of this garden, is the natural outcrop of rock, which, turned into garden rockeries with deep or shallow pockets, made or unmade, provides facilities for a varied collection of rock and succulent plants, with a few "stars" in the way of an odd bottle brush or gigantic lily. Both of these will stand such situation, and may relieve such plants as agaves, aloes, rochia, yuccas, cacti of various kinds (especially the Phyllocactus), hardy ferns, and creeping and crawling plants described in catalogues as prostrate and scandant—such as "pig-face" (botanically known as Mesembryanthemum), Sempervivums, Crassalas, and Burrawangs, not forgetting the grotesque and interesting Euphorbias. In some of these pockets Tom Thumb nasturtium may be sown, and the Cape daisy Gerbera Jamesoni planted; also many hardy perennial and herbaceous plants, such as thrift, candy-tuft, lily of the valley, and many of the irises. The aim should be to avoid overcrowding. One can rarely commit this error in a native plant border, but in a rockery the rule should be to see that a fair proportion of rock is visible, just as in ornamental water gardening one should show at least one-third of the area water.

No. 4 should be treated with four or five specimen flowering shrubs, such as hibiscus George Harwood, Jasminum primulinum, Brunfelsia latifolia, Ligustrum lucidum tricolor, and Strelitzia reginæ, growing out of a groundwork of ivy-leaved geranium, Vinca, ivy, polypom rose, herbaceous phlox, and any other such plants that do not demand continuous replenishment, and thereby continual work. Along the stone wall a row of roses, such as Radiance, Gruss an Teplitz, or Lady Brisbane should be planted, and in the bed marked roses the everblooming garden roses like Madame Abel Chatenay, Radiance, Red Radiance, Irish Fire Flame, Mrs. A. R. Wardell, Hadley, Hoosier, Beauty, and K. of K.

No. 5 will get no sun till past midday, so such a position will suit azaleas, fuchsias, begonias, and hydrangeas. The roof of No. 6 could be covered with wistaria, with the sides devoted to Antigonon, the Honolulu creeper, mixed with clematis. No. 7 could be gravelled and used for pot plants requiring a change from the house. The border marked 8, being in a good position, should be filled with choice climbing plants, like Allamanda, Clerodendron, Stephanotis, Thunbergia, and Antigonon, with the South African daisy, Gerbera Jamesoni, growing in front.

No. 9 (at the foot of the rock outcrop) is one of the best positions in the garden both for soil and aspect, and may be used for delphiniums, hollyhocks, petunias, carnations, or, in fact, anything that takes the fancy. No. 10 is also a nice warm border, and would suit a row of bouvardias. At No. 11 plant a wattle, broom and double flowering peach, and fill up the ground with eight or nine daphne (the rubra variety). At No. 12 plant a low hedge or something that will make a hedge quickly and that can be kept low, not more than 2 feet 6 inches or 3 feet high at the most—a tall hedge in such a position would be depressing. The ideal plant for this purpose is Cupressus sempervirens. If a formal clipped hedge is not desirable, then plant a hedge of the rose Lady Brisbane.

No. 13 is just the place for tall specimen shrubs of the deciduous type, such as Prunus cerasifera Vesuvius, double-flowering peach, flowering cherry, Magnolias soulangiana, purpurea, and stellata, bush-grown wistaria, poinsettia, and Erythrina speciosa. Underneath these, and especially near the path, may be clumps of iris, Crinums, Hippeastrums, daffodils, and many other plants of this character, planted in clumps to naturalise themselves At 14 a few well placed palms and scarlet flowering gums would make a good back-ground for the deciduous spring flowering subjects in 13. Suitable palms would be Cocos Yatay, Cocos plumosa, Chamærops humilis, Rhapis flabelliformis, and Phœnix reclinata. In between these could be grown clumps of dahlias, cosmos, or anything suitable for cutting purposes.

At No. 15 there should be a garden humus pit to decompose any garden refuse that collects from time to time. To hide this a clump of bananas should be planted, and in this area should also be found room for a loquat and lemon tree. As most of the drainage must fall to this corner, the ground should be planted with plenty of arum lilies or the Japanese iris.

At No. 16 the fence would give grateful shade to a collection of ericas of the Bowieana type. They should be grown in deeply-worked soil without manure, when the continuous wealth of flowers that half a dozen plants will afford should make a spot like this not the least attractive in the garden.

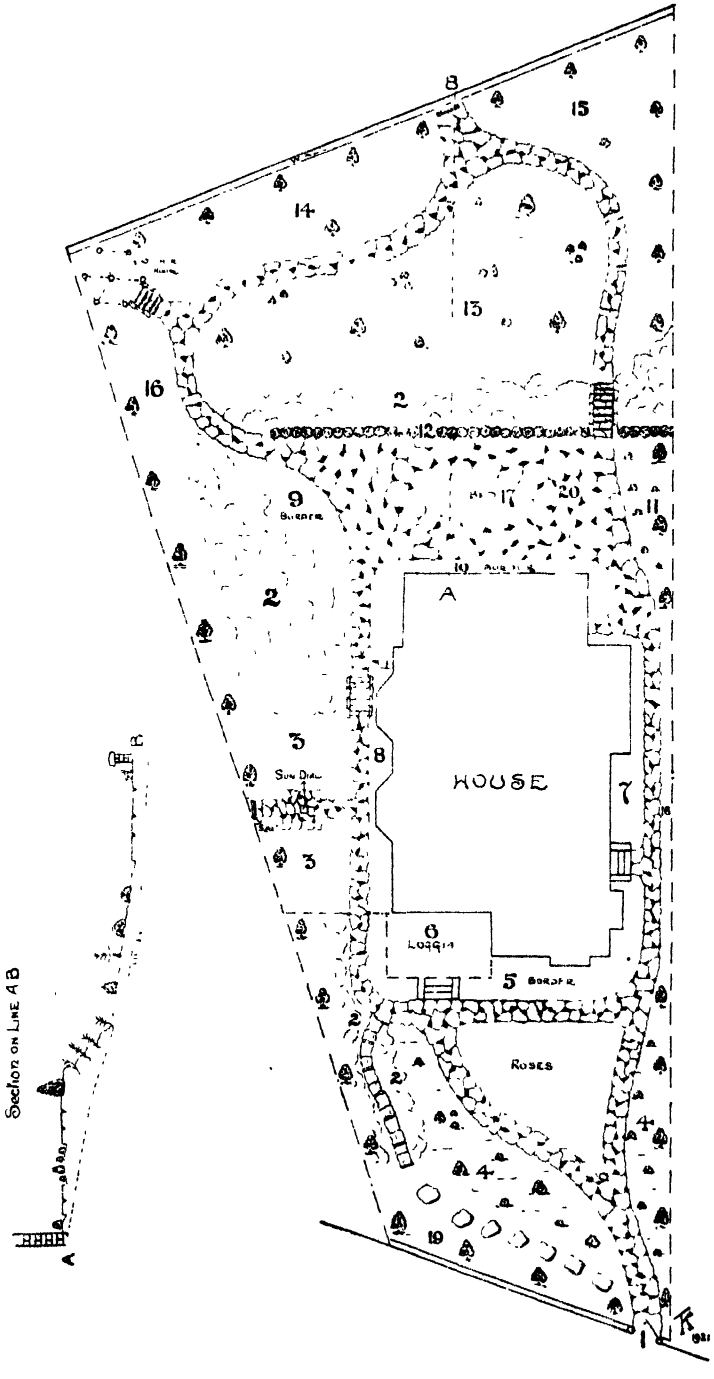
Honeysuckle and jasmine should be trained over the summer house.

In the narrow border No. 18, rocks or boulders should be used to form pockets, for it will be noticed that no steps have been laid (and this advisedly) between the side entrance to the basement rooms, a fall of 10 or 12 feet. Growing plants on such a slope in a place so draughty and so shaded from all sunshine is not an easy matter, but birds-nest ferns, aspidistras, fishbone ferns, and here and there in an extra good pocket, a hardy azalea, should prove satisfactory.

If a garage is needed, the only possible place is that marked 19, and this should be kept as low as possible.

Around Sydney, on the mountains, and on some of our coastal foreshores, there are many building sites broadly similar to that described; and although aspect and contour may differ from those in the case shown, the above plan and planting scheme should be suggestive to readers who are obsessed by the idea that turf banks and expensive retaining walls are essential to the successful treatment of such areas.

[**The sketches accompanying these articles** have been **drawn by** Mr. Thomas Kerr, **landscape gardener, Botanic Gardens.**]


Section on Line AB
A
B
Border
A
HOUSE
Sun Dial
Loggia
Border
Roses
R
1921

Pure Seed.

GROWERS RECOMMENDED BY THE DEPARTMENT.

The Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Wheat :—

Bomen	Manager, Wagga Experiment Farm, Bomen. T. J. A. Fitzpatrick, Erin Vale, Warre Warral. H. M. Hall and Sons, Studbrook, Cunningar. J. W. Eade, Eade Vale, Euchareena.
Canberra	Manager, Wagga Experiment Farm, Bomen. Manager, Experiment Farm, Bathurst. W. W. Watson, Woodbine, Tichborne. J. W. Eade, Eade Vale, Euchareena. H. M. Hall and Sons, Studbrook, Cunningar. Hughston Bros., Marsden-street, Boorowa.
Cleveland	Manager, Experiment Farm, Bathurst. J. W. Eade, Eade Vale, Euchareena. W. Burns, Goongirwarrie, Carcoar.
College Purple	Manager, Experiment Farm, Temora. Hughston Bros., Marsden-street, Boorowa.
Currawa	Manager, Experiment Farm, Temora. Hughston Bros., Marsden-street, Boorowa. J. W. Eade, Eade Vale, Euchareena. T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
Federation	Manager, Experiment Farm, Trangie. Harvey Bros., Enterprise, Dubbo. H. M. Hall and Sons, Studbrook, Cunningar
Firbank	Manager, Wagga Experiment Farm, Bomen. Manager, Experiment Farm, Trangie. J. W. Eade, Eade Vale, Euchareena Harvey Bros., Enterprise, Dubbo.
Florence	Manager, Experiment Farm, Trangie. Manager, Experiment Farm, Coonamble. Manager, Experiment Farm, Glen Innes.
Gresley	T. J. A. Fitzpatrick, Erin Vale, Warre Warral. Manager, Experiment Farm, Cowra Gollasch Bros., Milbrulong.
Hard Federation	Manager, Experiment Farm, Trangie. T. J. A. Fitzpatrick, Erin Vale, Warre Warral. H. M. Hall and Sons, Studbrook, Cunningar. J. W. Eade, Eade Vale, Euchareena.
Improved Steinwedel	Manager, Experiment Farm, Bathurst. Manager, Experiment Farm, Trangie. T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
Major	Manager, Experiment Farm, Temora. W. W. Watson, Woodbine, Tichborne. T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
Marquis	Manager, Experiment Farm, Glen Innes.
Marshall's No. 3	Manager, Wagga Experiment Farm, Bomen. Manager, Experiment Farm, Temora. T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
Penny	Manager, Experiment Farm, Temora. T. J. A. Fitzpatrick, Erin Vale, Warre Warral. W. W. Watson, Woodbine, Tichborne. E. J. Allen, Gregra. H. M. Hall and Sons, Studbrook, Cunningar.
Sunset	Manager, Experiment Farm, Coonamble.

PURE SEED—*continued.*

Wheat—continued.	
Waratah	Manager, Experiment Farm, Cowra.
Warden	Manager, Wagga Experiment Farm, Bomen. Manager, Experiment Farm, Bathurst. Manager, Experiment Farm, Temora. Manager, Experiment Farm, Cowra. J. W. Eade, Eade Vale, Euchareena. Gollasch Bros., Milbrulong. H. M. Hall and Sons, Studbrook, Cunningar.
Warren	Manager, Experiment Farm, Trangie.
Yandilla King	Manager, Wagga Experiment Farm, Bomen. Manager, Experiment Farm, Bathurst. Manager, Experiment Farm, Temora. T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
Zealand	Manager, Experiment Farm, Temora. J. W. Eade, Eade Vale, Euchareena.
Oats :—	
Algerian	Manager, Experiment Farm, Bathurst. Manager, Experiment Farm, Temora. Manager, Experiment Farm, Glen Innes.
Guyra	Manager, Experiment Farm, Cowra.
Lachlan	Manager, Experiment Farm, Cowra.
Ruakura	Manager, Experiment Farm, Glen Innes
Sunrise	N. S. Meek, Hobby's Yard.
Barley :—	
Kinver	Manager, Experiment Farm, Temora.
Cape	Manager, Experiment Farm, Bathurst. Manager, Experiment Farm, Coonamble.
Rye :—	
Black Winter	Manager, Experiment Farm, Bathurst.
Clovers :—	
Shearman's Clover (roots)	J. H. Shearman, Fullerton Cove, Stockton.

In addition to those tabulated a number of crops were inspected and passed, but as the growers failed to forward samples their seed has not been listed.

STRAW FOR MANURE.

INVESTIGATIONS carried out recently at Rothamsted (England) Experiment Station have demonstrated the value of adding a soluble nitrogenous fertiliser, such as sulphate of ammonia, for the purpose of accelerating the decomposition of vegetable matter to be used as manure. The process has been used with great success in the treatment of straw, which is first wetted thoroughly and allowed to lie until it has become damped through. The sulphate of ammonia is then spread over the surface (at the rate of ¾ cwt. to 1 cwt. per ton of straw) and conveyed in solution into the heap by applying water to the surface. It is necessary that the heap be kept in a moist condition throughout the period of decomposition.

TO OBTAIN ALCOHOL FROM POTATOES.

THE potatoes are washed, steamed and pulped, and strained into the wash-tub, where they are mixed with a small proportion of malt. This is then run into the fermenting vats where yeast is added, and the wash allowed to ferment for thirty hours, after which it is run into a still of the patent still type, and distilled.

This is probably the easiest of several methods, but it is very doubtful whether it would be profitable to prepare the spirit on a small scale.—F. B. GUTHRIE.

Poultry Notes.

MARCH.

JAMES HADLINGTON, Poultry Expert.

THE principal work on the poultry farm for this month will be a continuation of that advised in last issue. It will, perhaps, be profitable just now to deal with a few of the problems that are continually cropping up, and that seem to require explanation.

Probably one of the most unsatisfactory features in poultry farming, and one which is a fruitful cause of trouble on many farms, is the lack of knowledge and want of appreciation of the value of correct weights and measures in making up the daily ration for poultry. The kerosene tin and dipper (the latter of various sizes) are the utensils usually in use for proportioning the different ingredients which go to make the ration, and particularly the morning mash.

If the undefined weights or measures were confined to such articles as pollard and bran no harm would result, but it is in the use of meat or other concentrates, salt, and such articles, where lax methods or misinterpreted measures are highly dangerous and calculated to cause loss of valuable birds and much revenue. Having this in mind, and with a full appreciation of the disastrous consequences that often attend this feature, I have collected the materials for a table of weights for measure which, it is hoped, will be helpful to poultry farmers.

The Kerosene Tin

The kerosene tin is the measure most frequently used, as well as the common conveyor of poultry food on the farm. A tinful will weigh net, without the tin, approximately as under :—

	lb.		lb.
Pollard	18	Wheat (whole) .	30
Bran	12	Maize (whole)	28
Lucerne Meal	12	Maize (cracked)	25

Pounds per Quarter.

The following table shows the approximate weight per quart (quart measure filled but not pressed down) of the main ingredients in use on a poultry farm :—

	lb.	oz.		lb.	oz.
Wheat meal, per quart . .	1	8	Maize (whole), per quart .	1	12
Pollard ,, ...	1	0	Peas (whole) ,, .	1	12
Bran ,, ...	0	8	M.I.B. Meat meal ,,	1	8
Lucerne meal ,, ...	0	8	M.I.B. Compo meal ,,	1	8
Oat meal ,, ...	1	0	M.I.B. Bone meal ,, ...	1	12
Barley meal ,, ...	1	8	Common salt (fine), per quart .	2	0
Maize meal ,, ...	1	8	Flowers of sulphur ,, ..	1	4
Linseed meal ,, ...	1	0	Epsom salts ,, .	1	12
Wheat (whole) ,, ...	2	0			

A close perusal of the table will show that measure for measure of the different articles is a most unreliable way of computing proportions, nevertheless one frequently finds that these measurements are the sole means employed by the farmer to proportion the ingredients in the feeding and dosing of his birds. It is not possible to make a balanced ration by measure unless the measure is first tested and co-ordinated with weight.

A Dangerous Practice.

As the weights of, say, common salt, meat meals and like concentrated materials are so much greater than those of, say, pollard, &c., it will be apparent how disaster is likely to occur from the use of measures without knowing exactly the quantity by weight.

A whole string of troubles is likely to follow the excessive use of meat and other concentrates. Enteritis, over-stimulation of the ovaries, rupture of the oviduct, and many of the troubles to which a laying hen is liable, can result from this cause. Excessive quantities of meat or meat meals, when fed to breeding stock, will often result in partial failures in hatchings.

Salt Poisoning.

Many cases of salt poisoning come under notice, also due to guess measurement instead of weight. This is, however, by no means the only cause of salt poisoning. The most common cause is neglect of ordinary precautions in respect to its dilution. Poultry can stand a good deal of salt (very much more than is advised) providing it is properly diluted. But the smallest particles of it, if they come into contact with the crop undissolved, will injure or, perhaps, kill the bird.

Again, brine, in which salt meat has been pickled is another common cause. It should never be used in the food of poultry. All this will go to show how careful the farmer requires to be in the matter of weights, measures, and proportions, as well as in the incidence of mixing his mash.

Green Feed.

Green feed has now come to be regarded as an essential part of the dietary of poultry, and rightly so. Its use has been constantly advocated in these notes, and a leaflet has been issued by the Department giving information on the suitability of the different succulent fodders and how to grow them. There is, therefore, no reason why any novice poultry farmer should remain in ignorance of anything in respect to them in any way But, notwithstanding this, there are quite a number of new farmers who fail to appreciate the fact that such information as is made available to them has received the most careful scrutiny, and has been subjected to practical experience as to its reliability. Practically nothing has been left out that should be in, either with regard to the green stuff itself, or how to use it. It should be understood that because green feed is advocated it does not follow that any class of green food is suitable, or that even a class that is suitable in one stage of its growth is so in all stages. As an example of this, green maize, so long as it is succulent and tender and in the absence of some better fodder, may be chaffed up and used for poultry, but later on as it develops with age it becomes quite unsuitable owing to the large fibre content that has developed. The same thing applies when it becomes wilted with hot weather.

Beware of Sorghums.

Again, others having learnt that green maize is a tolerable food for poultry, imagine that anything like it in appearance must be equally as good. This idea has led some to feed on one or other of the different varieties of sorghum in the same way, which has in some cases led to trouble from prussic acid poisoning, the effect of which on poultry is somewhat different from that on other animals. Probably this is because the hens eat so little at a time compared with an animal that gets a full feed. However, the effect on poultry of feeding this material in those stages in which it contains prussic acid is a kind of chronic poisoning that affects the appetite and nutrition, and the young birds become anemic and lose flesh, while the mature hens are more or less affected in the same way. As a consequence, egg-production falls off in some cases to the vanishing point.

Again, the food value of such articles as green maize is so low that they should not be regarded as substitutes for more substantial food; in other words, they should be regarded as adjuncts rather than as the main food for poultry.

The case is, of course, different with regard to such substantial green food as lucerne and clover, but here again discretion is necessary not only in regard to feeding old stalks chaffed up, but in the practice of incorporating these materials in the morning mash. Even when good class lucerne is fed in the mash it should not exceed one-third of the bulk. If more is used the hens will not be getting the amount of nutriment necessary to support egg-production. Many cases have recently come under notice where the hens had almost ceased to lay owing to the use of too much green stuff in the morning mash. They had bulk, and yet were starving.

Don't Starve the Hens.

Many cases have also recently come under notice where too little food has been fed to laying hens. The poultry farmer should realise that hens can only lay well if fed well. At this time of the year, when the hens are moulting, they still require good feeding to maintain good condition with the view to early laying.

The wise poultry keeper feeds well at all times. It does not pay to underfeed.

The tops of the tomatoes sent by you show the condition known as "rosette," or "bunchy top." This condition has been prevalent during this season. No organism likely to be responsible for the trouble has been found associated with any of the plants examined. The disorder appears to be a seasonal one, and in the past has been met with in seasons of excessive rainfall.—G. P. Darnell-Smith, Biologist.

Orchard Notes.

MARCH.

W. J. ALLEN and W. le GAY BRERETON.

Harvesting.

MARCH to April is generally a busy time for the apple and pear grower of the tableland and later districts, for the bulk of the main varieties are ready for picking during this period.

This class of fruit, on the whole, set lightly this season, and, unfortunately, in many cases the crops have been further thinned by windstorms and hail. The latter not only damages the trees and crop, but also greatly increases the cost of handling what fruit remains.

Guides for picking and marketing have been given in these notes in previous seasons, and are also obtainable in leaflet form.

Pests.

During the busy time of marketing, one is tempted to neglect the regular collection and proper destruction of infected fruit. This, however, is a very shortsighted policy and one that will prove costly later on; moreover, it is most unfair to fellow growers in the district who faithfully carry out the work of destruction.

The dangers of fresh infection from returned or second-hand cases should not be overlooked, and where these are used proper precautions should be taken, otherwise the measures previously taken for the suppression of pests may be practically nullified.

As pointed out in last month's notes, it is not too late to fumigate for scale (red, brown olive, white, and pink wax) and louse on citrus trees. Indeed, one of the great advantages fumigation has over sprays for the control of citrus scale is that it may be delayed till practically all the eggs have hatched, whereas if sprays are similarly delayed they often fail to kill those insects that have hatched from the earlier eggs and that have had time to develop their protective coating; on the other hand, when sprayed early many eggs hatch out after the spray has been applied.

Green Manure Crops.

In the milder climates, if good autumn rains have set in, the sowing of peas for green manure can be continued during the early part of this month, though it is better to get them in earlier as directed in these notes last month. Such crops should be sown in conjunction with a mixture of superphosphate and bone dust, or superphosphate and blood and bone, half and half by weight.

There are certain warnings which cannot be repeated too often in reference to the practice of green manuring for the orchard. In the first place, it should only be attempted in districts where the rainfall is ample, or where water for irrigation is available. Secondly, should very dry weather set in during the autumn and there be danger of the trees suffering from the green crop robbing them of moisture, do not hesitate to plough at once; it is too risky to wait in the hope of rain. Thirdly, in any case, have the green crop all turned under by the middle of July, even if it has not reached full growth when ploughing is commenced If left later and the latter part of winter and spring are dry, not only will ploughing be difficult and the green crop perhaps fail to rot, but the trees will suffer from lack of moisture.

In districts where the normal rainfall is only just sufficient, and irrigation is not practised, the orchard should be ploughed as soon as possible after the fruit is removed from the trees, in order to give the land as much opportunity as possible of absorbing any rain that falls during the autumn and winter.

Planting Time.

In the milder districts, it is not too late to plant out citrus trees towards the end of this month, provided the ground has been well prepared before and is in nice moist condition. Even in milder climates frosts are liable to occur during the winter, and trees planted in the autumn should be protected by a few bushes put in around them before the winter sets in.

Where it is intended to put out additional areas of deciduous trees, the land should be ploughed and subsoiled as early as possible. It can then be left in a rough condition and will have every opportunity of absorbing any rain that falls in the meantime, and when cross-ploughed at planting time it should be in good condition to receive the trees.

Any roots that are torn out or found by the subsoiler should be burnt off. The orchard burner is a very useful contrivance for this work. One great advantage of using the subsoiler in preparing land for fruit trees in country liable to armillaria is that it very thoroughly discloses roots and stumps that have been missed and that can then be grubbed and burnt, and thus reduce a very common source of infection.

ROOTS *v.* SILAGE FOR DAIRY COWS.

THE use of silage has made great progress in the eastern counties of England in recent years, and experiments have been conducted to determine whether, as silage contains considerably more albuminoids than roots (like mangolds), it is possible to reduce the quantity of expensive concentrated food fed when silage is being used. The results are detailed by Oldershaw and Smith in the *Journal of the Ministry of Agriculture*, October, 1921.

The results suggest that 60 lb. silage was not equal in milk-producing capacity to 60 lb. mangolds and 4 lb. concentrated foods (decorticated cotton cake and dried grains), but the cost of the silage ration in the production of milk was ¾d. per gallon less than that of the root ration.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1922.

Society.	Secretary.	Date.
Bowraville A. Society	H. C. Newnham	Mar. 9, 10
Taralga P. and H. Association	J. J. Kearney	,, 9, 10
Hastings P. A. and H. Society (Wauchope)	A. D. Suters	,, 9, 10
Campbelltown A. Society	J. T. Deane	,, 10, 11
Miranda Agricultural Bureau	W. J. Buckland	,, 10, 11
Gundagai P. and A. Society	A. I. Fuller	,, 14, 15
Mudgee A. P. H. and I. Association	S. H. Somerville	,, 14, 15, 16
Armidale and New England P. A. and H. Assocn.	A. H. McArthur	,, 14 to 17
Cumnock A. Society	K. J. Abernethy	,, 15
Cobargo A. P. and H. Society	I. McKennelly	,, 15, 16
Crookwell A. P. and H. Society	C. H. Levy	,, 15, 16
Bangalow A. and I. Society	W. H. Reading	,, 15, 16
Barraba P. A. and H. Association	C. E. Williams	,, 15, 16, 17
Wallamba District A. and H. Association (Nabiac)	G. H. O'Connor	,, 16, 17
Luddenham A. and H. Association	L. W. Eaton	,, 17, 18
Coonabarabran P. and A. Association	G. B. McEwen	,, 21, 22
Batlow A. Society	C. S. Gregory	,, 21, 22
Tamworth P. and A. Association	F. G. Callaghan	,, 21, 22, 23
Nambucca A. and H. Association	M. Wallace	,, 22, 23
Nimbin A. and I. Society	B. V. Frith	,, 22, 23
Gulgong A. and P. Association	D. H. Spring	,, 22, 23
Hunter River A. and H. Association (Maitland)	J. S. Hoskins	,, 22 to 25
Bulladelah A. H. and I. Society	J. B. Watson	,, 23, 24
Goulburn A. P. and H. Society	F. D. Hay	,, 23, 24, 25
Merriwa A. and P. Association	V. Budden	,, 28, 29
Richmond River A. H. and P. Society (Casino)	P. M. Swanson	,, 29, 30
Macleay A., H., and I. Association (Kempsey)	R. T. Tarrant	,, 29, 30, 31
Camden A. H. and I. Society	C. C. Irving	,, 31, Apl. 1.
Lidcombe Agricultural Bureau	Mrs. A. Sellers	April 1
Cooma P. and A. Association	C. J. Walmsley	,, 5, 6
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins	,, 5, 6
Royal Agricultural Society of N.S.W.	H. M. Somer	,, 10 to 19
East Dorrigo A. Association	T. B. Timms	,, 15, 17
Orange A. and P. Association	G. L. Williams	May 2, 3, 4
Narrabri P. A. and H. Association	E. J. Kimmerley	,, 3, 4
Clarence P. and A. Society (Grafton)	L. C. Lawson	,, 3, 4, 5, 6
Hawkesbury District A. Association (Windsor)	H. S. Johnston	,, 4, 5, 6
Wellington P. A. and H. Society	A. E. Rotton	,, 9, 10
Lower Clarence A. Society (Maclean)	E. D. Munro	,, 10, 11
Dungog A. and H. Association	W. H. Green	,, 10, 11, 12
Coonamble P. and A. Association	J. C. Wilson	,, 23, 24
Murrumbidgee P. and A. Association (Wagga)	A. F. D. White	Aug. 22, 23, 24
Corowa P. A. and H. Society	J. D. Fraser	,, 29, 30
Junee P. A. and I. Association	T. C. Humphreys	Sept. 5, 6
Northern A. Association	J. T. McMahon	,, 7, 8, 9
Cootamundra A. P. H. and I. Association	Wm. A. Sowter	,, 12, 13
Holbrook P. A. and H. Society	Jas. S. Stewart	,, 19, 20
Temora P. A. H. and I. Association	A. D. Ness	,, 19, 20, 21
Murrumburrah P., A., and I. Association	W. Worner	,, 26, 27
Narrandera P. and A. Association	W. H. Canton	,, 27, 28
Ganmain A. and P. Association	A. R. Lhuede	,, 12, 13

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Agricultural Gazette of New South Wales.

Farmers' Experiment Plots.

WHEAT EXPERIMENTS, 1921.

Southern District.

G. C. SPARKS, Inspector of Agriculture.

THE location of the 1921 experiments was as under:—

G. Gow, "Hughenden," Barellan.
H. T. Manning, "Ravenstone," Barellan.
W. J. Martin, "Rotherwood," Barellan.
H. Horsburgh, "Wyuna," Beckom.
A. B. Dalgliesh, "Blair Athol," Berrigan.
E. C. Crawford, North Berry Jerry, Coolamon.
A. H. Jennings, "Urunga," Culcairn.
H. M. Hall and Sons, "Studbrook," Cunningar.
Carew Bros., "Selbourne," Deniliquin.
Eulenstein Bros., "Back Creek," Henty.
Ewan McRae, jun., "Evergreen," Lake Cargelligo.
H. W. Belling, "Bexley," Lockhart.
C. Henry Boyd, "Melrose," Milvale.
Johns Bros., "Wollongough," Ungarie.
W. R. Smith, "Rosedale Park," Yuluma, Urana,
J. T. Williams, "Forest Home," Wallendbeen.
D. and J. Gagie, "Spy Hill," West Wyalong.
R. H. Thackeray, "Woornack," Young.

Exclusive of the special oat and barley experiments, which will be reported upon separately, there were eighteen cereal experiments, ranging from fourteen to twenty-one plots of ¾ acre each, and covering the usual variety, manurial and rate of seeding trials, and tests of early *versus* late sowing.

Cultural Details.

Barellan (G. Gow).—Soil, dark; boree, gilgai country, south-west of Barellan. Ploughed July-August, 1920, soil wet; harrowed and spring-toothed early in summer. Weed growth very heavy and land heavily stocked. Spring-toothed and cross-harrowed before sowing; seed-bed shallow, very firm, slightly dry, but moist below. Germination of early plots weak, but stooling profuse. Early sowing on 7th May; late sowing 4th June; seed 50 lb., superphosphate 35 lb.

Barellan (H. T. Manning).—Soil, heavy red loam, south-south-west of Barellan. Ploughed July-August, 1920; portion spring-toothed in January, and disced in March; residue spring-toothed in March; seed-bed moist but shallow; late sowing spring-toothed again before seeding. Early sowing on 8th May; seed 50 lb., superphosphate 50 lb. Late sowing on 13th June; seed 52 lb., superphosphate 56 lb.

Barellan (W. J. Martin).—Light red loam; box and pine country, north from Barellan. Ploughed in June, 1920, disced in October; weed growth slight; disced in March, and harrowed in April; seed-bed moist and firm. Early sowing on 5th May; seed 45 lb., superphosphate 45 lb. Late sowing, area lightly disced before seeding; sown on 4th June; seed 55 lb., superphosphate 45 lb.

Beckom.—Light red loam. Ploughed in August, 1920; spring-toothed in October, February, April, and May. Sown on 9th May; seed 50 to 55 lb., superphosphate 45 lb.

Berrigan.—Red loam, sandy; land had been pastured for six years. Ploughed in July, 1920, grazed until April, 1921; disced. Sown on 13th May; seed 45 to 50 lb., superphosphate 56 lb.

Coolamon.—Chocolate loam. Ploughed in September, 1920; spring-toothed in October; disced in April. Seed-bed for early sowing in good order, moist with cloddy surface. Late sown area harrowed before sowing; seed-bed over-moist. Early sowing on 29th April; seed 45 lb., superphosphate 45 lb. Late sowing on 3rd June; seed 55 to 60 lb., superphosphate 45 lb. Early-sown plots badly affected with flag smut.

Culcairn.—Red loam; box country. Sown to rape in March, 1920; fed off and ploughed in October, 1920. Sown on 19th May; seed 60 lb., superphosphate 50 lb.

Cunningar.—Red loam. First cropped in 1920; ploughed in June, 1921. Harrowed behind drill to cover the seed and set the ground; seed-bed very moist. Sown on 22nd June; seed 50 lb., superphosphate 60 lb. Firbank plot was badly damaged, apparently by a whirlwind.

Deniliquin.—Black clay loam. Ploughed in September, 1920, spring-toothed in March, rolled in May, spring-toothed early in June, and harrowed before sowing. Sown on 27th June; seed 60 lb., superphosphate 40 lb.

Henty.—Grey clay loam; cropped since 1899. Ploughed in October, 1920, disced in March, spring-toothed in May, harrowed before sowing; seed-bed in good order, cloddy surface, moist. Sown on 17th May; seed 55 lb., superphosphate 50 lb.

Lake Cargelligo.—Red loam. Ploughed in August, 1920, harrowed in March, and harrowed again before sowing. Sown on 17th June; seed 50 lb., superphosphate 45 lb.

Lockhart.—Heavy red loam. Ploughed at end of July, 1920, spring-toothed in September and November, disced in March. Early sowing on 27th April; seed 50 lb., superphosphate 60 lb. Late sowing on 6th June; seed 55 lb., superphosphate 60 lb. Late sowing failed; 3 inches of rain followed seeding, and was in turn followed by dry frosty weather, a hard crust being formed.

Millvale.—Red loam. Ploughed in August, 1920, wet; harrowed in September, disced in April. Early sowing on 30th April; seed 45 lb., superphosphate 56 lb. Late sowing on 6th June; seed 55 lb., superphosphate 60 lb.

Ungarie.—Red loam. Ploughed in October, 1920; spring-toothed in March. Early sowing on 3rd May; seed 50 to 55 lb., superphosphate 52 lb. Late sowing on 23rd June; seed 60 lb., superphosphate 63 lb. A trace of flag smut occurred in early-sown varieties.

Urana.—Red loam; new land, yellow box, pine, and bull-oak. Ploughed in October, 1920, harrowed in January, disced prior to seeding. Early sowing on 27th April; seed 48 to 50 lb., superphosphate 60 lb. Late sowing on 17th June; seed 60 lb., superphosphate 65 lb. Seed-bed in good order, but rather deeply worked. Plots severely damaged by grasshoppers, and yields considerably reduced. Firbank escaped much damage owing to being too ripe at the time of the attack, hence its comparatively high yield.

Wallendbeen.—Red loam. Ploughed in September, 1920, and again in February; spring-toothed in April. Sown on 9th May; seed 50 lb., superphosphate 56 lb.

West Wyalong.—Clay loam. Disced in March, spring-toothed in April. Seed-bed in ideal condition, germination excellent. Early sowing on 2nd May; seed 50 lb., superphosphate 56 lb. Late sowing on 6th June; seed 55 lb., superphosphate 60 lb. Flag smut was very bad in all early-sown plots except Yandilla King; late-sown plots clean, except for a trace in Comeback.

Young.—Red loam. Ploughed in September, 1920, harrowed in November, disced in February, spring-toothed in April. Sown on 21st June; seed 52 to 55 lb., superphosphate 56 lb.

Season.

The rainfall during the fallow periods was comparatively heavy, but owing to the disastrous harvest weather of 1920-21 and the consequent prolongation of harvesting operations (in one instance at least until March, 1921), the fallow was, on the whole, rather neglected, and little advantage was taken of the copious summer rains, with the result that at seeding time the fallow was, in most cases, no better than stubble as regards moisture content. Owing also, no doubt, to the abovementioned conditions, supplies of seed for the experiments were unusually late in coming to hand, and the seeding of the experiments started precisely eighteen days later than in 1920. Because of this delay, the benefits of the early April rains were very largely lost and the experiments were subjected to a protracted period of dry weather that lasted until after the middle of May—germination being adversely affected.

Growing conditions varied quite considerably. In the west or earlier portion of the district, July was extremely dry and cold, Ungarie registering only 33 points of rain for the month and Barellan 42 points. Over this area, however, the spring weather was almost perfect, although the late sowings never seemed fully to recover from the check received in July. Over the eastern or later portions of the district, the winter weather was much more favourable, but the crop was badly cut up by a brief spell of intense heat early in November, much pinched grain resulting.

Rainfall during Fallow, 1920-21.

	Barellan.	Berrigan.	Culcairn.	Deniliquin.	Henty.	Lockhart.	Coolamon.	Wallendbeen.	Ungarie.	Young.
1920.	Pts.	Pts.	Pts	Pts.	Pts.	Pts	Pts.	Pts.	Pts.	Pts.
August ...	...	280	..		...	289	230	...	...	...
September ..	.	299	...	204	..	245	276	...	...	229
October	193	161		183	239	195	187	...	45	104
November ...	177	195	.	116	191	356	77	.	249	271
December .	155	98	.	60	80	96	488	...	210	270
1921.										
January	230	102	128	20	54	...	76	112	208	185
February ..	180	275	162	62	94	129	138	56	52	17
March	80	83	299	92	230	257	134	127	95	119
April	197	118	203	109	60	123	210	227	122	216

Rainfall during Growing Period, 1921.

	Barellan.	Berrigan.	Culcairn.	Deniliquin.	Henty.	Lockhart.	Coolamon.	Wallendbeen.	Ungarie.	West Wyalong.	Young.
1921.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts.	Pts	Pts.	Pts.	Pts.
May ...	135	257	256	217	232	180	266	198	222	229	333
June ...	210	275	321	212	193	210	111	284	254	298	154
July ..	42	219	242	111	183	106	97	133	33	54	281
August ...	212	209	218	106	190	159	139	214	106	121	192
Sept ...	180	173	387	222	414	290	183	179	129	162	150
October ..	122	109	245	210	197	157	142	139	108	176	101

Notes on Varieties.

One of the outstanding features was the performance of *Bomen*, a wheat that has figured for many seasons in these trials. It gave the highest individual yield of the series, viz., 38½ bushels at Wallendbeen, topped each of the three Barellan experiments, and was very high up on the list elsewhere.

Canberra again yielded most consistently, although its comparative yield was advanced by the late sowing of the bulk of the experiments. At the same time there is absolutely no questioning the fact that for grain production Canberra has completely replaced all the old early maturing wheats. There is no justification for utilising any other variety for late sowing for grain, and in spite of its rather weak straw it is being sown on yearly increasing areas.

The results from *Federation* were rather disappointing. It headed the lists at Lockhart and Ungarie, but elsewhere was easily outyielded by several other varieties. As is well known, Federation is extremely disease-liable, and the prevalence of flag smut and, in some cases, of rust, was no doubt largely responsible for its comparatively poor showing.

Gresley, tried for the second time in these experiments, amply justified its inclusion and is becoming very popular in the drier portions of the district. It is to be anticipated that it will be sown very extensively this year.

VARIETY Trials.

Variety.	Barellan (G. Gow).		Barellan (H. T. Manning).		Barellan (W. J. Martin).		Beckom.		Berrigan.		Coolamon.		Culcairn.		Cunningar.		Deniliquin.	
	bus.	lb.	bus	lb.	bus	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus	lb.	bus.	lb.
Bomen	37	27	27	25	23	51	23	40	30	29	...		29	30	...		16	43
Bunyip	...		...		...		...		...		...		...		...		...	
Canberra	29	51	17	52	21	48	24	33	30	49	20	15	31	17	16	42	20	32
Cedar	...		...		...				...		...		...		...		...	
Comeback	...		...		...		...		...		...		...		...		...	
Currawa	...		...		...		...		24	32	25	36	26	16	22	7	17	55
Daphne	...		...		...		...		...		...		...		...		...	
Dart's Imperial	...				...		...		...		...		...		...		...	
Federation	27	56	23	54	23	26	20	5	26	45	21	51	28	1	14	51	15	27
Firbank			...				17	7	...		16	52	...		9	3*	...	
Florence	25	51	16	13	18	37	20	10	22	33			25	38	16	55	...	
Gallipoli	...		...		...		21	40	...		...		...		...		17	55
Glencope	...				...		...		...				...		16	34	...	
Gresley	...		...		...		25	1	28	28	20	21	31	52	14	48	16	49
Hamel	...		...								...		...		20	31	...	
Hard Federation	29	32	16	40	18	1	20	16	27	53	20	32	26	9	15	10	19	3
Improved Steinwedel	20	8	12	45	15	13	...		23	25			...		...		...	
Marshall's No. 3	...		...		...		...		...		22	24	29	49			...	
Penny	25	3	21	19	19	56	16	12	22	53	19	51	25	40	9	47	9	53
Queen Fan	...		...		...		...		...		...		...		...		...	
Thew	...		...				...		...		...		...		15	40	...	
Waratah			...		...		23	15	...								16	59
Warden	...						...				22	22	27	10	18	0	...	
Warren	...		...		...		...						...				...	
Wilfred	...		24	29	20	29	19	35	24	45	...		24	14	19	49	12	8
Yandilla King	34	28	19	38	20	32	23	31	25	45	21	44	27	5	...		...	
Zealand	...		...		...		...		...		16	16	...		...			

Variety	Henty.		Lake Cargelligo.		Lockhart		Milvale.		Ungarie		Urana.		Wallendbeen.		West Wyalong.		Young.	
	bus.	lb	bus.	lb.	bus	lb.	bus	lb	bus.	lb.	bus	lb.	bus.	lb.	bus.	lb.	bus.	lb.
Bomen	25	40	17	37	20	49	12	20	24	53	21	11	38	34	...		...	
Bunyip	...		20	19			...		...				...		...		...	
Canberra	29	1	22	33			12	9	19	27	22	39	35	42	24	55	28	25
Cedar	...		...		...		...		...		...		...		21	7	...	
Comeback	...				...		...		13	26			...		15	58	...	
Currawa	...		19	44	23	43	10	44	24	43	20	7	27	38	...		27	35
Daphne	...				...		...		...		...		...		...		18	4
Dart's Imperial			16	2	...		...		...		...		...		...		...	
Federation	19	30	18	29	24	1	9	52	27	20	15	38	32	10*	18	41	19	4
Firbank	...		18	13	...				13	52	25	30	20	33	...		...	
Florence	...		18	54			9	23	16	6	16	40			...		24	16
Gallipoli					...		...				...		...		28	39	26	23
Glencope	22	56	...		...		...		...		...		...		22	48	...	
Gresley	24	59	...		...		8	52	24	49	17	39	26	54	26	49	23	54
Hamel			...		...		...		...		...		...		...		...	
Hard Federation	26	5	20	30	...		9	9	18	51	18	15	23	37	...		28	8
Improved Steinwedel	...		17	58			...		17	13	11	26	...		...		...	
Marshall's No. 3	25	28			23	51	12	21			...		28	38	...		21	28
Penny	...				17	22	9	23	23	24	15	56	27	56	...		13	27
Queen Fan	...		...		...		...		...		...				...		18	37
Thew	...		...		...		...		...		...		...		...		18	4
Waratah	...		...				...		...		...		...		25	1	23	1
Warden	27	45	...		23	4	13	55	...		...		31	12	...		24	32
Warren					...		...		19	12	...		...		22	20	...	
Wilfred	25	35	...		...		...		23	45	...		...		15	12	25	37
Yandilla King	25	43	18	35	22	4	11	1	24	41	19	15	27	51	27	17	19	23
Zealand	...		...		...		...		...		...		23	37	...		...	

* Storm damaged.

The comparatively poor showing of *Penny* was due in every instance to weak germination resulting in a thin stand, the variety being a poor stooler. The trouble was evidently due to defective seed.

Several varieties were included for the first time in these experiments. *Gallipoli,* a Victorian variety with the reputation of being highly prolific, returned the highest yield at West Wyalong in an early May sowing, but was beaten by several varieties in a mid-May sowing at Beckom. It is a late-maturing, short-strawed wheat, with an erect brown coloured, clubbed head. There were quite a number of distinct types present in the Gallipoli plots, it being evidently unfixed.

Waratah variety has already been described in the *Gazette*. In a June sowing at West Wyalong it outyielded Canberra, but at Beckom and Deniliquin positions were decidedly reversed. It is stronger strawed than Canberra, and will be extensively tried out during 1922.

Wilfred, a West Australian variety closely resembling Hard Federation, was included in eleven experiments, and although in October it looked like yielding heavily the results were somewhat disappointing.

Glencope, Hamel, Daphne, and Queen Fan were also included at Young and Cunningar, but owing to the unduly late sowings at both these centres the results were not comparable.

Manurial and Other Trials.

All the manured plots gave satisfactory increases of yield as against no manure.

While the standard rate of application for the southern district—56 lb.—retains its place, the success achieved by the dressing of 84 lb. is noteworthy; and this with the results of previous experiments would seem to indicate that the heavier amount would prove remunerative at least in late districts such as Henty and Culcairn.

MANURIAL Trials.

Amount of Superphosphate per acre.	Barellan (G. Gow)	Barellan (H. T. Manning).	Barellan (H. J. Martin).	Beckom.	Berrigan.	Coolamon.	Culcairn.	Cunningar	Deniliquin.
	bus. lb	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus lb.	bus lb	bus. lb.	bus. lb.
Nil	22 13	17 35	18 17	12 35	25 33	16 5	15 45	9 4	..
28–30 lb.		..	.	..	..	20 39	21 31	.	..
40–45 lb.	27 56	21 47	..	20 5	..	21 51	..	..	15 27
56–60 lb.	.	26 11	23 25	21 35	..	23 16	28 1	13 12	..
65–70 lb.	27 25	..	23 39	20 45	29 5	..		..	14 40
84 lb.		..	..	..	29 3	24 33	84 9	10 31	..

Amount of Superphosphate per acre.	Henty.	Lake Cargelligo.	Lockhart.	Milvale.	Ungarie.	Urana.	Wallendbeen.	West Wyalong.	Young.
	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.	bus. lb.
Nil	9 35	16 40	15 12	6 0	26 4	11 12	36 49	19 28	14 7
28–30 lb.	19 47	19 5	19 43	6 35	27 41	16 29	..	18 28	18 13
40–45 lb.	..	18 29	..	8 23	..	..	.	..	..
56–60 lb.	20 55	19 3	24 1	9 52	27 20	15 38	32 10*	18 41	19 4
65–70 lb.	23 31	..	.	..	..	.	..	..	..
84 lb.	23 21	..	22 9	10 3	30 31	19 21	41 34	16 4	19 1

* Storm damaged.

The variety used was Federation.

EARLY v. Late Sowing.

Locality.	Early sown.			Late sown.		
		bus.	lb.		bus.	lb.
Barellan (G. Gow).... ...	May 3,	27	56	June 4,	25	23
Barellan (W. J. Martin) ...	May 5,	23	26	June 4,	17	12
Coolamon	April 29,	21	51	June 3,	19	35
Urana	April 26,	15	38	June 17,	10	46

The variety used was Federation. The seed was sown as follows:—Early sowing 45 to 50 lb., late sowing 55 to 60 lb. Superphosphate was sown in the following quantities:—Early sowing 50 to 56 lb., late sowing 60 to 65 lb.

Each of the four experiments showed a substantial margin in favour of early sowing, which was quite in common with the results of previous seasons.

RATE of Seeding Trial.

Amount of Seed.	Henty.		Wallendbeen.		Ungarie		W. Wyalong.	
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.
30 lb. per acre. ..	...	..	...	..		.	18	56
38 lb. ,, ..	......		...	..	27	48	....	
40 lb. ,, ...	......		......		.	.	19	29
50 lb. ,, ..	19	30	32	10	27	29	18	41
60 lb. ,, ..	19	7	32	15	27	16	22	17

The variety used was Federation.

At West Wyalong, where the plots were badly infected by flag smut, the heaviest rate of seeding was, as was to be anticipated, the highest yielding. At other centres, however, the medium to light rates of seeding proved most profitable.

Vicinity of Murrumbidgee Irrigation Areas.

A. N. SHEPHERD, Assistant Inspector of Agriculture.

ALTHOUGH the land adjoining the Murrumbidgee Irrigation Areas may be considered as within the drier parts of the State, wheat-growing, if carried out under sound farming methods, is very profitable. Adjoining the Irrigation Areas, but not irrigable, is land that at present is being made available for settlement, chiefly as additional holdings, and in many instances this land is being utilised for wheat-growing with very satisfactory results.

Several farmers have this season co-operated with the Department in the carrying out of trials, both variety and manurial, namely:—

J. Leitch, "Glenlee," Leeton.
M. McKenzie, Leeton.
G. John and Son, Griffith.

The early part of the season was very favourable, good rains falling both before and after sowing, and until about October, when a dry spell set in. The weather was very unseasonable during the spring and early summer, very hot weather being experienced, followed by cold snaps. The rainfall registrations at Leeton were as follows:—May, 135 points; June, 214; July, 54; August, 163; September, 233; October, 119; November, 21.

Leeton (*J. Leitch*).—The soil was a nice sandy loam—pine country. The land has been cropped for a number of years, the previous crop being wheat. It was ploughed in February following rain, and after a short fallow was harrowed and drilled on 4th May. The rate of seeding was 45 lb. per acre. A manurial trial—varying quantities of superphosphate being used—was conducted. The fertilised plots, and more especially those receiving a heavy dressing, made the most rapid growth, and at the same time gave the heaviest yields.

Leeton (*M. McKenzie*).—A variety trial was conducted on this farm on fallow land, the soil being a red loam. The land was ploughed in the early spring, 1920; cultivated in December, 1920; harrowed in April, and drilled 30th April at the rate of 45 lb. seed and 45 lb. superphosphate per acre. A very good germination was obtained, and satisfactory growth followed. It was especially noticeable that the later maturing varieties gave the better returns. The low yield from Firbank was attributed to the loss of grain by the straw breaking before the crop was stripped.

Griffith.—Sown on land that could be irrigated, if necessary, were a number of varities of wheat in a variety trial. The previous crop was wheat with 56 lb. superphosphate per acre. The land was ploughed in April, harrowed, and drilled on 8th May at the rate of 1 bushel of wheat and 56 lb. superphosphate per acre. Splendid growth followed a good germination. A heavy hailstorm in October practically destroyed the Firbank plot. As on the other plot, the later maturing varieties gave the heavier returns.

The yields were as follows:—

Variety.	Griffith.	Leeton. (M. McKenzie).
	bus. lb.	bus. lb.
Marshall's No. 3	10 0	28 7
Yandilla King	10 0	......
Bomen	9 45	27 8
Warren	9 30	......
Hard Federation	8 20	25 48
Gresley	8 20	......
Canberra	8 0	24 12
Improved Steinwedel ...	7 30	... .
Florence	7 0	22 30
Firbank	2 0	13 29
Major	......	25 56
Zealand	.. ...	20 12

The fertiliser trial at Leeton (J. Leitch's farm) resulted as follows:—

	Bus.
70 lb. Superphosphate	30
56 ,, ,, ...	28½
45 ,, ,, ...	27
30 ,, ,, ...	27
No manure	15

All seed was pickled previous to sowing, being treated with bluestone and lime.

ARTIFICIAL FARMYARD MANURE.

As a result of investigations carried out at the Rothamsted (England) Experiment Station, it has been found that straw can be converted into an excellent imitation of farmyard manure with the help of nothing more elaborate than water and some soluble nitrogen compound, of which sulphate of ammonia is at present the most easily obtainable. Repeated experiments have shown that the most rapid breakdown of a straw occurs when some source of nitrogen is supplied, and then only in those cases where the reaction of the solution is neutral or slightly alkaline. As sulphate of ammonia tends to be acid, finely-ground chalk or limestone must be used with it to neutralise the solution. For general purposes three-quarters of a hundredweight of sulphate of ammonia and one hundredweight of finely-ground chalk per ton of straw are sufficient to induce fermentation.

The process of making the manure is quite simple. The only trouble arises from the tardiness with which straw takes up the moisture necessary for fermentation. It is suggested that the most effective method is to water the straw lightly at first, and leave it for a couple of days. During this time a slight fermentation with increase of temperature sets in, rendering the straw more capable of absorbing a second slight application of water. When examination shows that the interior of the heap has become uniformly moist, the sulphate of ammonia and chalk can be broadcasted over the surface and watered in. After this, fermentation soon becomes more rapid, and may be assisted by turning the heap to admit air, just as is done with ordinary farmyard manure when the desire is to make it heat and rot down quickly.

Manure made as described must be inferior to real farmyard manure, in that it is not a complete fertiliser. It must be considered as supplying only nitrogen and humus. But it is an easy matter to provide the necessary phosphates and potash in the form of mineral fertilisers.—*The Gardeners' Chronicle.*

MANY failures with cauliflowers can be attributed to the use of seed that has not been selected from good heads. Good quality seed is of first importance. It is advisable to have the crop mature before the very cold weather, as there is then very little growth, and the heads are prone to damage from frost if not properly protected.—A. J. PINN, Inspector of Agriculture.

PRYOR BARLEY.

This variety was introduced into Victoria and then into this State from the Peninsula, South Australia. It is probably a native of Chili, where brewers often get barleys of good quality, though the best samples come from Asia Minor. Some years ago we received a pound or two of Chilian barley from Messrs. Tooth & Co., Ltd., and in the resulting crop, two or three plants of a different variety appeared. These in course of time were identified with Pryor barley, though known for some seasons as Cowra No. 21. It thus appears likely that the Pryor variety came from Chili.

The variety ripens earlier than Kinver, Invincible, Goldthorpe, Standwell, and Golden Grain, and the straw is not very tall, though slender. A heavy stooler, it is able to mature plump grain because of its early ripening qualities, and is therefore suited to the warmer districts of the State, such as the Wagga, Tamworth, and Dubbo country. We have a cross between Kinver and wild barley (*H. spontaneum*) which resembles Pryor. Further tests will be necessary to determine which variety is the more productive.

Without discussing barley growing generally, we may quote Mr. Richardson's remarks from the Victorian *Journal of Agriculture*, in favour of barley :—

1. It makes excellent winter grazing for all kinds of stock. A barley paddock heavily grazed this winter promised to yield over 40 bushels grain.
2. It gives heavy yields of silage.
3. The grain is excellent food for stock, especially pigs.
4. It usually gives 50 to 100 per cent. heavier yields than wheat.
5. Being earlier ripening, it is very drought resistant—more so than wheat.

Looking at the other side of the question we may state some disadvantages :—

1. It is liable to foul the wheat-growers' paddocks unless he is a careful farmer.
2. It is susceptible to foot-rot and take-all diseases, like wheat, and it will therefore carry the fungi over from one season to another.
3. It is risky to harvest if sown in large areas on account of lodging.
4. The beards are some disadvantage in feeding the hay to stock.

We have had good results from feeding barley to horses, but the grain should be soaked, especially if it is new. Barley straw is much liked by cattle and horses.

As far as yield per acre goes, statistics show that for the mixed farm this cereal cannot be neglected. For a period of forty years in the United States of America the average yield of barley per acre has been well above that of wheat and oats. The same experience held good over a twenty-six year period in Ontario. Mr. Niel Nielsen, in his report on bulk handling some years back, stated that barley was the most profitable crop grown in America; though the yield per acre from maize was higher, the returns were 14s. 6d. per acre lower than for barley.—J. T. PRIDHAM, Plant Breeder.

Lamb-raising Trials at Bathurst.

F. B. HINTON, Sheep and Wool Expert.

In determining the combination of breeds most suitable for the raising of "early" lambs it is not only necessary to select those breeds which will give the best returns per head for the lambs, but to ensure that the combination will give the best net return—that is, the best return after the cost of the ewes lost at lambing has been deducted. This fact was kept in mind in last year's lamb-raising trials at Bathurst Experiment Farm.

Two flocks, each comprising 106 two-tooth Lincoln-Merino ewes, were employed, one flock (*a*) being mated with three South Down rams, and the other (*b*) with Dorset Horn rams. The two lots of ewes were of equal quality, the original lot of 212 being divided into the two flocks through the drafting race. The mating period covered eight weeks (22nd February to 18th April, 1921), and during that time the flocks were yarded twice weekly to ensure better service. The Dorset Horn rams were the slower, but eventually worked well. At the conclusion of the mating the rams were withdrawn and the ewes boxed. From this time to the time of trucking the lambs the ewe flocks were run together on the same pasture.

During pregnancy the ewes were run in ordinary grass paddocks. When lambing commenced they were run on fallowed land and oaten fodder crop for two and a half months, then on fallowed land and grass paddocks for one and a half months, and thereafter on stubble, lucerne and grass paddocks until trucking.

In flock (*a*) thirty-six ewes required assistance at parturition, two dying; and in flock (*b*) twenty-nine ewes were assisted, three dying. The deaths were in each case due to injuries caused by obstructed birth, and in view of the fact that the ewes were maiden ewes this proportion of deaths cannot be considered high. From the flock mated with the South Down rams (*a*), 104 lambs were dropped, and of these 88 were marked. From the flock mated with the Dorset Horn rams (*b*), 98 lambs were dropped, and of these 83 were marked. In each case the loss in lambs at birth was due to the size of the shoulder of the lamb obstructing delivery, most of the cases occurring during the night, the lambs being found in the morning either dead or too weak to save.

The lambs were trucked at the age of 5 to 6 months, and sold in the open market at Homebush. The eighty-eight Lincoln-Merino x South Down lambs brought £81 6s., or an average of 18s. 6d., and the eighty-three Lincoln-Merino x Dorset Horn lambs £83 17s. 5d., or an average of £1 0s. 2½d. From these returns must be deducted, however, the losses in ewes. Thus, from the £83 17s. 5d. returned by the Dorset Horn cross must be deducted the value of three ewes at 25s. each, which leaves £80 2s. 5d., or a net return per head for the 106 ewes mated of 15s. 1d.; while from the £81 6s. returned by the South Down cross must be deducted the value of two ewes at 25s., which leaves a net return of £78 16s., or 14s. 10½d. per head of the ewes mated.*

The figures show very definitely the value of lamb-raising for the wheat and sheep farmer, indicating an average net return per ewe for the lamb alone of 14s. 11½d. for the twelve months.

The results obtained from the two crosses, though not revealing a very great difference, show the Dorset Horn cross to have a slight advantage. An aspect of the trials that is worth noting is that in no case was the death at parturition of ewes served by the Dorset Horn rams caused by the size of the head of the lamb, notwithstanding the belief prevalent among many lamb-raisers that there is considerable likelihood of loss from this cause.

That the ewes yielded such a return within twelve months of mating, and that the carrying capacity of the land returned to normal at the end of this period, are points with significance for the farmer who is maintaining the greatest number of sheep commensurate with the carrying capacity of his land.

THE CHARGE FOR DEPARTMENTAL PUBLICATIONS.

As was pointed out over a year ago, when the Department first announced the necessity of charging for some of the larger of its publications, the New South Wales farmer is by no means the only one who is nowadays being asked to contribute something toward the cost of the Government publications specially dedicated to his interests. The cost of production has increased so enormously during recent years all over the world that similar departments of agriculture have everywhere found that there is a limit to what they are justified in providing absolutely free. Here is what the February issue of the *Journal of the Ministry of Agriculture* (London) has to say on the subject:—

"The end of the year saw one change which, at first, may meet with the approval of few and the disapproval of many, namely, the decision to make a charge for leaflets, contributory to the cost of their production. Apart, however, from the fact that the Ministry was compelled to take this step by the need for economy, many who dislike the change will agree that, as the information in these leaflets has a commercial value, those who require them should contribute to the cost of their production. Moreover, if the appreciation of information of any kind does not necessarily increase in proportion to the price paid for it, there is little or no doubt that too easy acquisition breeds not appreciation but waste, and to that extent the fact of payment does add to the value of a leaflet, and is at the same time an economy. The demand for leaflets has been very heavy, and it should be remembered that if the Ministry is able to send a copy of any one of its leaflets free to any applicant, it does not follow that this can apply to the whole 385 issued, or even to a dozen of them."

*** These figures do not take into account expenses in connection with the sale of the drafts.**

Wheat Variety Trials.

TEN YEARS' RESULTS (1911–20) AT GLEN INNES EXPERIMENT FARM.

R. G. DOWNING, B.Sc. (Agr.), Senior Experimentalist,
and L. G. LITTLE, Experimentalist.

WHEAT in New England does not occupy the primary position that it does in the wheat belt of the State, for the scope of the New England agriculturist includes a greater number of crops. Such crops as oats (eminently suitable and grown largely for hay), maize (which, with the introduction of suitable early maturing varieties, is becomingly increasingly popular for the better class soils), and potatoes (on the richer types of soil), all take prior place in present agricultural practice.

Wheat takes a secondary place because (*a*) it is liable to rust in most seasons; (*b*) owing to wet summers prime wheaten hay cannot be produced here in competition with the wheat districts; (*c*) all wheats tend to lose flour strength (to such an extent, in fact, that at one time it was considered that the district could not produce a satisfactory flour wheat); and (*d*) in this and similar districts wheat is a poor soil crop and will not return the profit from a rich soil that maize or potatoes will on a 30-inch or better rainfall.

The experience on Glen Innes Experiment Farm, however, is that conditions (*a*) and (*c*) have been largely overcome by the cultivation of improved varieties, and that concerning condition (*d*) there are large areas of poorer soil, such as that on which the plots are situated, upon which wheat might be cultivated with profit. The main points to be considered in determining the suitability of a variety to this district are therefore (1) rust resistance, (2) resistance to frost and climatic extremes, (3) ability to withstand and make most profit from conditions of (for wheat) excessive moisture, (4) ability to produce a grain of reasonable quality, and (5) suitability for hay.

The experiment now under discussion was commenced in 1911, and the time is opportune for the summarising of the first ten years' results. The object of the experiment was to determine the most suitable varieties of cereals for the New England district. Preliminary trials are made with most new varieties in the Plant Breeder's plots on a small scale, and only suitable varieties are transferred to the field plots.

Until 1920 the rotation was a three-course one, comprising (*a*) experiment plots (wheat and oats variety trials), (*b*) renovation crops (rye grass and red clover), and (*c*) maize for silage. Such a rotation involved the experiments in delays in planting, so that the plots were never sown earlier than midseason and were often late. Farm experience has shown that early-sown wheat crops are invariably heavy, and more frequently escape rust.

As only one sowing is made in the variety trial, data as to the suitability of certain wheats for specified sowing is based on behaviour in the field and and the seasonal characters of the varieties.

Where summer crops are rotated with wheat and other winter crops there is room for the growing of late-maturing varieties to be planted in April or May after, say, oats, and also for the growing of quick-maturing varieties to be sown in July or August, after the maize has been harvested. Such practice is quite sound in this district of almost assured rainfall.

The plots are situated in a comparatively low-lying area. The soil is greyish, clayey, poor agriculturally, derived from metamorphic ironstone, and typical of a considerable area of the poorer class of soils in the western slopes part of the district. It is shallow, varying in depth, and overlies a stiff yellow clay. The land is unsuitable for maize or potatoes, but is satisfactory for wheat and oats. Great improvement in its condition has been effected during ten years' cropping under the rotation outlined.

The plots are sown with the ordinary 15-disc seed drill. They measure 13·5 links by 480 links to accommodate one width of the drill, the length being reduced as required before harvesting. One-half of the plot (7½ drills) is harvested for hay and the other for grain. Hay is cured in the paddock, usually after being cut by hand, and the grain portions of the plots are harvested with the reaper and binder and threshed by threshing machine.

The yields have been affected by weather influences just as ordinary crops in the field would be affected, and are the net results after all risks have been run. In 1913 storms at harvest did some damage, but on the whole far less trouble is experienced from storms than from other causes. The results are from midseason to late plantings, and some varieties have been influenced considerably. Haynes' Blue Stem, for instance, has suffered because of its unsuitability for any but early plantings. Florence has dropped back in the midseason plantings. Clarendon has been favoured in late plantings. Most of the varieties are not greatly different from Genoa (the check variety) in the matter of season.

The average yield of the check variety of 18 bushels per acre for the ten-year period is satisfactory. As it costs more to produce wheat here (principally owing to the heavy nature of the soil), the yields need to be good to make any profit. An average of nearly 2 tons hay may also be regarded as satisfactory. Jonathan was used as the check variety in 1911 and 1912, Genoa being grown as an ordinary variety. The results were altered to bring Genoa on to the basis of 100 per cent. and so make the yields uniform through the whole period.

The figures for 1918 and 1919 are not true hay yields, as the plots were harvested for grain, and the weights of the sheaves were taken just prior to threshing.

Notes on the Varieties.

Jonathan.—A well-known old variety of good milling qualities. It was outclassed by Genoa and rejected. It was too tough to thresh for the best results to be obtained.

Haynes' Blue Stem.—A variety which has been recommended for this district for many years. It is a long-season wheat, and has done poorly in the trials. It produces a light chaff, is liable to shell, and is now being discarded in favour of some wheats which have done well in this trial.

Genoa.—Our standard wheat. Has done consistently well over the entire period, and is recommended for use in the district.

Cedar.—A well-known hard wheat. Failed to yield well, and was rejected early. Also a difficult variety to thresh.

Cleveland was only tried for one year and did badly. Experience lately has shown it to be worthy of a further trial, and it has been reintroduced into the variety trials.

Florence.—Although not as good as Genoa in the experiments, excellent results have been obtained from this variety when sown after maize on the farm paddocks. It is our standard late planting variety, and is considered by the local miller to be an excellent flour wheat, and the best for that purpose in the district.

Warren.—Strongly rust resistant, but a very poor flour wheat; was rejected in favour of Florence.

Medeah and Huguenot.—Two macaroni varieties which were tried and found far behind the bread wheats. They are not recommended for ordinary purposes. The chief object in growing Huguenot is to supply seed to coastal farmers who grow it for green fodder.

Comeback is not suitable for the district. It is susceptible to frost, and is a light yielder.

Cowra No. 3 has been grown for some years. In its general purposes it is similar to Genoa, but is much inferior and therefore being rejected.

Marquis.—This variety comes out worst of all for the three years 1912–14 In 1918 it yielded in another trial about 75 per cent. as compared with Genoa 100 per cent., and in 1920 it yielded 53 per cent. as against Cleveland (check) at 100 per cent. in the late wheat trials.

Hawkesbury No. 4 proved unsuitable. It shells, and is a light yielder of good quality grain.

Thew is not recommended, as Florence will do better in all general requirements.

Nardoo has been rejected by the Department. A hay wheat, but did not come up to expectations.

Clarendon.—One of the most satisfactory of the new wheats; very early maturing, and suitable for late planting. It is very rust-resistant, and is recommended for late sowing.

Canberra does fairly well on an average; as it is rust-liable it is being rejected in favour of Clarendon.

Cowra No. 15.—A wheat which needed excellent conditions to do at all well, and was soon found unsuitable.

Early Haynes' Blue Stem.—A specially early and good strain of Haynes' Blue Stem, selected in 1903 by Mr. Farrer. It has not been milled. It is rust-resistant, midseason, and produces reddish (Fife) grain. It is liable to shell out. On its performances in the variety plots it is recommended for trial on a larger scale.

HAY Yields.

No. of years averaged.	Years when grown.	Varieties in order of merit.	Yield per acre based on percentage yield.		
			t.	c.	q.
4	1917-1920	Early Haynes' Blue Stem	2	5	0
3	1918-1920	Glen Innes No. 2	2	2	1
4	1917 1920	Glen Innes White	2	0	2
10	1911-1920	Genoa	1	18	0
6	1915-1920	Clarendon	1	17	3
10	1911-1920	Florence	1	15	0
9	1912-1920	Cowra No. 3	1	14	3
3	1915-1917	Canberra	1	14	2
7	1911-1917	Haynes' Blue Stem	1	14	1
5	1911-1915	Jonathan	1	13	3
3	1914 1916	Nardoo	1	13	2
3	1918-1920	Wagga No. 31	1	11	3
3	1911-1913	Huguenot	1	10	2
6	1911, 1913-17	Warren	1	10	2
3	1912-1914	Marquis	1	9	2

GRAIN Yields.

No. of years averaged.	Years when grown	Varieties in order of merit.	Yield per acre based on percentage yield.	
			bus.	lb.
6	1915-1920	Clarendon	22	3
4	1917-1920	Early Haynes' Blue Stem	20	56
4	1917-1920	Glen Innes White	20	3
10	1911-1920	Genoa	18	22
3	1915-1917	Canberra	17	24
3	1918-1920	Glen Innes No 2	16	33
10	1911-1920	Florence	16	27
5	1911-1915	Jonathan	16	11
6	1911, 1913-17	Warren	15	48
9	1912-1920	Cowra No. 3	15	15
3	1914-1916	Nardoo	14	51
3	1918-1920	Wagga No. 31	14	40
7	1911-1917	Haynes' Blue Stem	12	52
3	1911-1913	Huguenot	12	0
3	1912-1914	Marquis	10	43

In these tables are shown varieties which have been tested over at least three years. Others (some tried and discarded, others at present on trial, but not yet tried for three years), are mentioned under the heading "Notes on the Varieties."

Glen Innes White.—A selection from a white-grain strain of New England Red Lammas, made by Mr. R. H. Gennys, and grown by Farrer in 1903. It has not been milled since 1908, but is known as a very soft wheat. Mid-season in growth, it is a good hay variety.

College Hunter.—Though in the year grown in these plots it shows a comparatively good yield, it is totally unsuited to the average season. It is an importation from New Zealand, very late, rust-liable, and is being rejected.

Wagga No. 31.—Another mediocre variety which, after many years, has finally to be rejected. It is outclassed by Genoa, and is not further recommended.

Glen Innes No. 2 (Early H.B. Stem x H.B. Stem x Zaff).—A good hay variety that would for this purpose be suitable to replace the old Haynes' Blue Stem variety. Its grain-yielding powers are not as high as Genoa, and it has not been tested for milling, although it appears to be a soft wheat. It was grown at Glen Innes in 1916, and named in 1917.

Glen Innes No. 3 (M.B. Sa. x Jonathan x Warren).—This variety is rust-resistant and a grain producer, although it shows good hay-yielding capacity as well. Has only been tried in the field for two years; grown at Glen Innes in 1916, and named in 1917.

CHARCOAL DUST AND SCREENINGS FOR AGRICULTURAL PURPOSES.

THE principal fertilising ingredient of charcoal would be potash, with a small proportion of phosphates. The following figures may serve as a guide:—

100 lb. wood yields, on the average, about 20 lb. charcoal and 2 lb. ash.
100 lb. wood-charcoal contains, on the average, 97 lb. carbon and 3 lb. ash.
100 lb. wood ashes (mixed hardwood) contains, on the average, about 3 to 4 lb. potash (K_2O).

In other words, wood-charcoal contains about ½ per cent. potash, which would make its manurial value, at rates ruling in 1921, about 6s. 3d. per ton.

In Europe woodlands of a peatty nature are often partially burnt or charred and the charred stuff dug in at the rate of 30 to 40 bushels per acre if drilled, or 100 to 250 bushels if broadcasted. It is said that turnips are particularly benefited by such treatment, and the seed germinates quickly.—F. B. GUTHRIE.

IT would only be in years of a glutted market that raisins would be turned into spirit, and when spirit is cheap the conversion of raisins into spirit would be a poor proposition for the grower. According to South Australian experiments 1 ton of raisins will produce 90 to 150 gallons of proof spirit, according to the quality of the raisins.—H. L. MANUEL, Viticultural Expert.

THE CAMPAIGN AGAINST TICKS IN OTHER COUNTRIES.

VARIOUS reports are in the hands of the veterinary officers of the Stock Branch indicating how wide-spread is the struggle against external parasites, particularly ticks. The work of eradication of the cattle tick continues in the United States, and the reports of the Department of Agriculture show that in the year ending 30th June, 1920, 50,555 square miles were freed from ticks and released from quarantine. Up to date 70 per cent. of the originally infested area has been released from quarantine since 1906. In Montana the same work is being carried out with regard to another tick—the one responsible for spreading Rocky Mountain spotted fever. The measures adopted against this tick are dipping, rodent destruction, quarantine, hand-picking, the use of tick repellants, and the regulation of grazing on unfenced land. It was found that indiscriminate grazing on unfenced foothills was a constant source of infestation. Roadside grazing is prohibited, and owners of dairy cattle, work horses, &c., are required to free them from ticks by hand-picking at least one each week, and to destroy the ticks.

Other countries are also taking active steps against these pests. For instance, in Porto Rico, where up to the present is it reported that eradication work has not been too successful, a definite anti-tick campaign has been commenced, the number of dips available having been greatly increased.

Canada is taking similar action as regards mange in cattle, and a report of the Veterinary Director-General indicates that the affected areas have been placed in quarantine, and the movement of cattle out of them prohibited, except for immediate slaughter at a designated abattoir, or unless they have been twice dipped under the supervision of an officer of the Department of Agriculture. By these means the extent of infection has been gradually lessened, and the quarantine restrictions have been removed from certain areas.

It is evident that veterinary authorities all over the world are pushing a vigorous campaign against the external parasites of stock.

CONTROLLING WORMS IN PIGS BY SANITATION.

A NEW and apparently effective method of controlling worms in young pigs has been devised by the United States Department of Agriculture, according to the *Weekly News Letter*. The system is described as simplicity itself.

"First, it is necessary to clean the farrowing pens with hot water and lye. Then wash the dirt from the skins of the sows before farrowing and put them in the clean pens. Within two weeks after farrowing remove the sow and pigs to a clean pasture and keep the young pigs on clean pasture for at least four months."

The *News Letter* relates that at a certain exposition (or show) in McLean County, Illinois, there would be shown a litter of six pigs that gained during a certain period, only 171 lb.; in a neighbouring pen would be shown another six-pig litter, kept on the same feed as the first litter, which gained 322 lb. in the same time. The first litter were wormy, the second were not,

"In order to produce strong, healthy, profitable pigs, it is, of course, necessary, that they have good feed, water, and shelter, in addition to worm-free surroundings."

Farmers' Experiment Plots.

HAY TRIALS ON MURRUMBIDGEE IRRIGATION AREAS.

A. N. SHEPHERD, Assistant Inspector of Agriculture.

THE area sown for hay in the irrigation area is considerable, and with the number of larger mixed farms being made available, it will doubtless be increased.

It is held by many that hay can be grown cheaper under dry-farming conditions, or where irrigation is not practised, but on irrigation lands a crop can be grown every year, and provided suitable rotations and short fallows are adopted, it is not necessary to allow the land to be idle for any length of time. Under irrigation smaller holdings will suffice, failure should be unknown, and the work can be extended throughout the whole year.

By giving a short fallow, and if necessary an irrigation before sowing, it is possible to obtain a good germination, and there being sufficient water in the soil to carry on till the winter rains, the crop makes rapid growth, thus assuring heavy yields. Under normal conditions, if the land is sown early with good moisture content very little irrigation is required, one soaking in the spring being usually all that is necessary.

The undermentioned farmers co-operated with the Department in carrying out trials during the past season:—

W. Edwards, Farm 367 (oat variety trial).
L. R. Brown, Farm 297 (oat and wheat variety trial).
M. McKenzie, Farm 203 (oat and wheat variety trial).
E. Roufeldt, Farm 796 (oat and wheat variety trial).
P. C. Moran, Farm 802 (oat and wheat variety trial).
R. Tiffen, Farm 319 (manurial trial).

The early season was very favourable, the seed going into a bed containing plenty of moisture, good germination and quick growth resulting. An exceptionally heavy fall of rain was experienced in June (nearly three inches in one day) and this had a very detrimental effect on the crops on the heavy grey soil where the water is inclined to lie for some little time.

The rainfall was as follows:—April, 122 points; May, 179; June, 257; July, 54; August, 163; September, 233; October, 119.

The Plots.

Farm 367.—On this farm a variety trial with oats was sown on 13th April in a heavy red clay soil. The land received a short fallow, being ploughed in February, cultivated in March, then harrowed and checked in April previous to drilling. The previous crops had been maize with 70 lb. of superphosphate.

Four varieties of oats were used in the trial, all being sown at the rate of 1½ bushels to the acre; a second plot of the Sunrise variety was sown at the rate of 2 bushels per acre. This heavily seeded plot gave a return of 6 cwt. per acre more hay than the one sown with 1½ bushels, which justified the use of the extra half-bushel. It has been repeatedly noted that where only 1½ bushels of Sunrise is used the crop is rather thin. All varieties were fertilised with 70 lb. superphosphate per acre.

It was found necessary to irrigate this plot in May, the crop having made very rapid growth in the meantime. All varieties were more or less attacked with rust, Guyra being the worst, and Algerian the best in this respect. The crop was cut on 28th October, and gave very good returns, although trouble was experienced in cutting, due to lodging.

TABLE showing Results of Wheat Variety Trials.

Variety.	Farm 802.				Farm 297				Farm 203.				Farm 796.			
	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.	t	c.	q.	lb.
Improved Steinwedel ..	1	15	3	13		....			1	19	3	25		....		
Gresley ...	1	12	2	21	2	6	2	16	3	4	2	10*	2	18	3	6
Canberra . ..	1	11	3	6		.....			1	8	1	14	2	8	2	8
Florence	1	10	3	16		.....			1	11	0	7	2	0	0	5
Firbank .. .	1	10	3	12		......			1	3	2	15	2	5	3	17
Warren	1	9	3	12		.....			1	18	0	10	2	9	2	3
Zealand ...	1	9	3	0	2	12	2	2	1	14	3	21		......		
Bomen	1	8	3	14		.....				.....				.....		
Marshall's No. 1 .	1	8	2	0	2	7	1	24	1	5	0	23	2	3	1	23
Warden	1	8	0	18	2	11	3	16	3	3	1	7*	2	15	0	6
Gundilla King .	1	5	8	14	2	3	0	0	1	5	2	7	2	0	1	15
Hard Federation . .	1	4	0	26		.....				......				......		
Mayor	1	3	2	16		.....				.....				...		

* These plots were sown on a red, sandy loam, much better soil than the remainder of the plot.

TABLE showing Results of Oats Variety Trials.

Variety.	Farm 367.				Farm 297.				Farm 203.				Farm 796.			
	t.	c.	q.	lb.	t.	c	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.
Algerian	3	16	0	6	1	10	3	3	2	1	2	21	2	16	0	27
Sunrise (2 bus. per acre)	3	2	2	20		...				.....				.....		
Guyra	2	16	2	10	1	7	3	3	1	11	3	4		....		
Ruakura	2	17	1	24	1	4	0	4	1	11	0	1	2	2	1	4
Sunrise (1½ bus. per acre)	2	16	1	11	1	9	2	8	1	13	3	12	1	17	1	2

FERTILISER Trial at Farm 319.

Fertiliser per acre.	Wheat yield (Zealand).			Oats yield (Algerian).		
	t.	c.	q.	t.	c.	q.
*M 7—92 lb.	2	4	1	2	1	0
*M 5—106 lb....	2	3	1	2	0	1
*M 6—112 lb.... .. .	2	1	2	2	0	3
Superphosphate—140 lb. ...	2	1	1	2	6	1
Superphosphate—70 lb. ...	2	0	0	2	5	3
No manure	1	16	0	1	19	3

* The various mixtures are made up as follows:—M 5, superphosphate 2 parts, sulphate of ammoni 1 part; M 6, superphosphate 5 parts, chloride of potash 3 parts; M 7, superphosphate 10 parts, chloride of potash 3 parts.

Farm 203.—The soil consisted of a grey clay of the heavier type. Two varieties of wheat (Gresley and Warden) were sown on a nice sandy loam; this accounts for the big differences in the yields. The previous crop had been sorghum where the oats was sown and oats where the wheat was grown, with 70 lb. superphosphate in both cases. The rate of seeding was 60 lb. per acre. The land was ploughed in March, cultivated in April, and harrowed and the seed drilled on 30th April. The heavy rains in June had a very bad effect on this crop. The crop was cut on 11th November, and although heavy yields were not obtained, the quality of the hay was first class.

Farm 297.—On this farm the variety trial of wheat was sown on 21st April, on a red clay loam, and the oats on 12th May, on a grey soil. Similar rates of seeding were employed with 70 lb. superphosphate. The wheat was rather patchy at the start, but gave a very good crop. The oats were on the light side.

Farm 796.—The land received a thorough preparation, being ploughed in March and well worked until it was sown on 3rd May, the same seeding being adopted as on the other plots; with 70 lb. superphosphate. The previous crop had been Sudan grass, 1920, with 70 lb. superphosphate. The crop was cut on 27th October, a very nice even sample being obtained.

Farm 802.—This plot was sown late (17th June) on a red loam. The land was irrigated previous to ploughing in May, and then rain following delayed sowing. Although light, hay of a very good quality was obtained.

Farm 319.—A red sandy loam on the block was sown with oats in the form of a manurial trial. The previous crop had been oats and wheat cut for hay, but owing to early sowing the crop lodged badly, so this season sowing was delayed until the 4th June. The land was ploughed in February, irrigated previous to sowing, cultivated and harrowed before drilling with seed at the rate of 60 lb. per acre.

LIQUID DISCHARGE FROM GASWORKS.

THE liquid effluent from certain gasworks were submitted for analysis, with a question whether it would be of any value for manurial purposes.

The analysis showed the liquid to contain—

Nitrogen, ·238 per cent.
Equal to ammonia, ·289 per cent.

It was alkaline in reaction, and contained sulphate, sulphides, cyanides, and sulpho-cyanides.

Before use it should be diluted with three or four times its bulk of water. Such liquid is sometimes used as a fertiliser, and, owing to the presence of the ammonium salts, has a beneficial action.—F. B. GUTHRIE.

Corowa Growing Crop Competition.

[The following is from the report of Mr. G. C. Sparks, Inspector of Agriculture, who, with the approval of the Under Secretary and Director, acted as judge in the above competition in the past season.]

THE competition, conducted under the auspices of the Corowa Pastoral, Agricultural, and Horticultural Society, was for the best 40 acres of wheat—of not more than two varieties—grown in the district, and judged by the following points: Yield, 40 points; trueness to type, 20 points; freedom from disease, 20 points; freedom from weeds, 10 points; evenness, 10 points. There were eleven entries, but one was withdrawn.

Two competitors only availed themselves of the privilege of submitting two varieties, and in all twelve crops were inspected, made up of the following varieties: Bomen, 4; Federation, 3; Turvey's Purple Straw, 3; College Purple, 1; Warden, 1.

The performance of *Bomen* is very pleasing. This is one of the standard varieties in the Riverina. It was produced at Wagga Experiment Farm, and is of French-Fife-Indian parentage. "It ripens a little later than Federation, carries a good head, bold, white, and tapering; makes a tall, stiff straw, with little flag; stands well, is rust resistant, but has a slight tendency to shell, and is susceptible to frost."

Federation, as is generally known, is the result of an attempt to produce a short-strawed, drought-resistant variety, eminently suitable for Australian harvesting conditions. How successful was the effort is indicated by the great popularity of this variety. It is, however, very disease-liable, and in a "rusty" year yields are almost certain to be greatly reduced.

Turvey's Purple Straw, or Turvey, is a Victorian variety that is becoming very popular throughout the southern Riverina. It is identical with Burgowannah, or Ortlipp's Burgowannah. It is purple-strawed; the straw is brittle when ripe, and very apt to lodge. It is a good dual-purpose variety, but is, apparently, more suitable for hay than for grain.

College Purple, bred at Dookie, is a highly-productive wheat that is becoming very popular, notably about Wagga. It is club-headed and tip-bearded, with brittle straw.

Warden, also from Dookie, is one of the finest hay wheats in cultivation, and is also a prolific yielder of grain. It has bold, white, tapering ears, red grain, and the straw is tall, and of excellent quality.

Trueness to Type.—Throughout the crops there was a pronounced mixture of wheats of other varieties. This, of course, detracts very much from their value as show crops, and may also be regarded as objectionable from a practical view-point. Any admixture of varieties is detrimental, and especially when the "strangers" mature at a different date from the sown crop.

Details of Awards.

Name.	Variety	Cultivation.	Seed.	Superphosphate.	Apparent Yield.	Trueness to Type.	Freedom from Disease.	Freedom from Weeds.	Evenness.	Total.
			lb.	lb.	pts.	pts.	pts.	pts.	pts.	pts.
1. J R. Hudson, Corowa..	Bomen	Fallowed, August, 1920. Twice disced ...	49	50	32	18	19	8	9	86
2. { C. Howard, Balldale...	Warden ...	Fallowed, August, 1920. Harrowed once. Disced once. Sown, 22nd April.	60	56	29	18	19	9	8	83
2. { F. W. Knight and Sons, Ringwood.	Federation ...	Fallowed, August, 1920. Cross harrowed, September. Disced and sown end of April.	53	40	30½	16½	18	9	9	83
4. A. McDonald, Balldale...	Bomen	Fallowed, September, 1920. Harrowed, October. Disced and sown in May.	60	56	30	17	18	7½	9	81½
5. James Benson, Ringwood	Bomen	Fallowed, September, 1920. Harrowed once. Disced once.	50	Nil.	29	18	16	9	9	81
6. W. Tait, Ringwood ...	Federation ...	Fallowed, August, 1920. Twice disced and harrowed.	50	56	28½	18	16	8½	8	79
7. E. O. Piggin, Hopefield	Bomen	Fallowed, June, 1920 Disced and sown June, 1921.	50	45	28	18½	13	8	9	76½
8. F. Howard, Balldale ...	College Purple and Turvey.	Fallowed, August, 1920. Harrowed. Disced once. Spring-toothed once.	45	56	27	15½	15	10	7½	75
9. { J. A. Nixon, Ringwood	Turvey . ..	Fallowed, August, 1920. Disced, November and March. Sown April.	40	40	30	18	10	8	8	74
9. { M. Synnott, Collendina	Federation and Turvey.	Fallowed, September, 1920. Disced in April. Harrowed twice.	60	45	29	18	11	8	8	74

The competitive crops could have been truer to type, and as all the fields inspected were on fallow, the trouble probably lies with the seed. In the past great importance has been placed upon environment, *i.e.*, seed-bed, manuring, &c., but it is now understood that *seed* plays an equally important part, and that maximum yields cannot be secured from even the most highly cultivated land unless the seed is of the best possible type and most prolific strain. Supplies of pure seed are now readily available, and it should be the business of every farmer to determine first what wheats are most productive in his district, and most suited to his own climatic and economic conditions, and then to secure even small supplies of pure seed of those varieties, and by careful cultivation—by seasonable sowings on clean fallow—to develop a supply of seed sufficient for his needs.

Freedom from Disease.—Rust was very prevalent, some of the crops being very severely attacked. There was also a little take-all, but practically no smut. The intensity of rust attack is mainly dependent upon the spring weather being favourable to the development of the disease, and the only practical methods of control are early sowing and the use of rust-resistant varieties such as Yandilla King and Bomen. It might be advisable here to make a reference to the common practice of making extremely late sowings of wheat when the work has been delayed by prolonged periods of wet weather during the sowing season. This cannot be too strongly condemned. When seeding is not completed in due season it is advisable to leave the ground "out" and fallow it for the following season. Only in very rare instances do these extremely late sowings show a profit. The spring weather has to be very favourable for them to do so, and, further, they mature at a time that renders them peculiarly liable to attack in a "rusty" season.

Take-all can, however, be definitely controlled by bare fallowing and change of crop. This disease is becoming very widespread in the wheat belt, and every effort should be made to hold it while there is yet time. Seed treatment and change of seed wheat are quite useless. Bare fallow and change of crop are quite effective. The change crop most applicable to wheat belt conditions is unquestionably oats; only in very rare cases has the take-all fungus been known to attack this crop.

Freedom from Weeds.—The crops were, on the whole, reasonably weed free; being on fallow and having made heavy straw growth, this was, of course, to have been expected. Black oats and various thistles were the only weeds in evidence.

Evenness.—The crops were fairly even, although there was in some cases a tendency to lodge—the most prolific source of loss of points in this section.

IF you have a good bull and he is of no further use to you sell him to a good breeder, and not to the butcher. The more good heifers his new owner raises and tests the greater value may be placed on your animals.—*Seasonable Hints* (Canada).

Insects Infesting Stored Grain in New South Wales.

AN ANNOTATED LIST OF SPECIES OCCURRING DURING 1916–18.*

T. McCARTHY, Assistant Entomologist.

OWING to the lack of transport during the years 1914 to 1918, it was necessary to stack large quantities of wheat in various parts of New South Wales, under conditions in many ways favourable to the development of insect pests. Consequently the stacks were soon infested with a number of species, including many kinds of cosmopolitan insects well known as pests of stored grain. The insects commonly met with damaging the grain were almost all widely distributed species, whose range had been undoubtedly extended by commerce. It happens, therefore, that the species responsible for the bulk of the damage in the wheat stacks were, with one or two additions, identical with those doing similar damage in other countries.

The following is merely a list indicating the species associated with the stored wheat, together with a brief reference to the part played by each in the destruction of the grain:—

Grain Beetles.

Common Grain Weevil (*Calandra oryzae*, Linn.).—This insect is a cosmopolitan pest of great importance, and is the best known of all insects attacking stored grain. It is widely distributed in Australia, and is the chief agent in the destruction of stored grain in this country, attacking the grain both as a grub and as an adult beetle. The most noticeable effect on the grain is that produced by the adults. The effect of the activities of the larvæ on the grain is not easily distinguishable, since they do all their work inside the grain. The adults gnaw small, almost circular holes into the grain, their long snouts being particularly adapted for the purpose. They do not, however, consume the entire starchy contents of the grain in the way that the Lesser Grain Borer (*Rhizopertha dominica*) does, consequently, as mentioned below, attacks of the two insects can be easily differentiated. The insect is winged, and can fly readily when it so desires.

Granary Weevil (*Calandra granaria*, Linn.).—Closely allied to the preceding beetle, it can be readily distinguished from it by being wingless and by the absence of the four reddish brown spots on the elytra that are present in the preceding species. Although world-wide in range, this weevil is not so generally distributed as the Common Grain Weevil (*C. oryzæ*), nor is it responsible for anything like the same destruction. In Australia it is chiefly confined to the colder areas of Victoria and South Australia, rarely, if ever, occurring further north. It was responsible for much damage in Victorian and South Australian stacks, but was not present in New South Wales.

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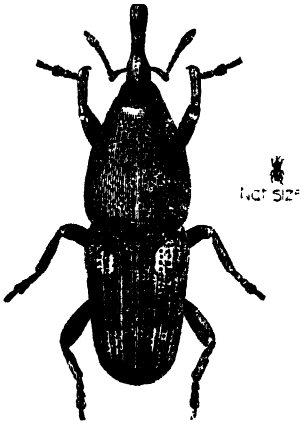
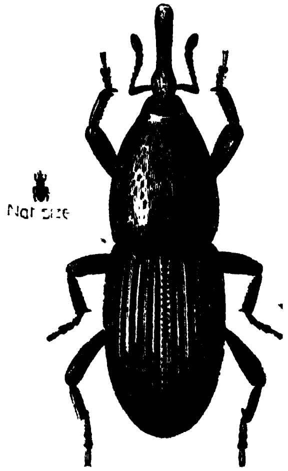
* This article was written two or three years ago; its publication has been delayed by various circumstances.

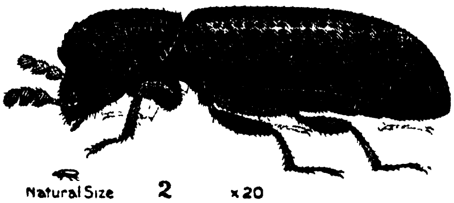
Lesser Grain Borer (*Rhizopertha dominica*, Fab.).—This is a serious pest of stored grain, also of wide distribution. It seems, however, to prefer coastal areas, being chiefly found in the vicinity of big seaport towns. In Australia its range seems to have been restricted to the coastal areas of New South Wales and South Australia, where wheat was stacked in large quantities. It belongs to the wood-boring beetles of the family *Bostrychidæ*. It prefers grain to other dry products, but it also shows an inclination to be omnivorous, feeding also upon drugs, and boring into the wood of packing-cases and casks. It can readily be distinguished from the two grain weevils (*Calandra*) by its cylindrical form and small size. The prothorax is rounded and crenulated, covering the head, which is not prolonged into a distinct snout, as in the grain weevils. The antennæ are ten-jointed, and terminate in a three-jointed club. The attack of the Lesser Grain Borer (*R. dominica*) is quite characteristic. The most noticeable part of the damage is that effected by the adults. Grains are seen in which the whole of the starchy interior has been eaten away, leaving the pericarp of the seed empty and riddled with large irregularly-shaped holes. A large



Common Grain Weevil (*Calandra oryzae*)



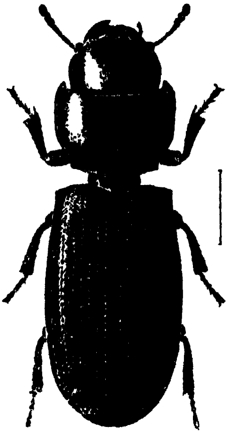
Granary Weevil (*Calandra granaria*).



Lesser Grain Borer (*Rhizopertha dominica*).

amount of white floury frass soon accumulates, for the insect spoils almost as much of the grain as it consumes (if not more) by reducing it to the condition of flour. Newly-hatched larvæ cannot enter a grain that has the pericarp of the seed entire, but a slight abrasion in it seems to be quite sufficient to enable the larvæ to enter the grain. The activities of the adults, however, must render a large percentage of the grain suitable for attack by the larvæ, while the frass and floury material produced often affords a means whereby the young larvæ are able to tide over the earlier stages, if not successful in finding a suitable grain to attack at once. The attack of this beetle can readily be distinguished from the Common Grain Weevil (*C. oryzæ*) by the destruction of the whole starchy interior of the seed and the large irregular holes in the pericarp.

Khapra Beetle (*Trogoderma khapra*, Motsch).—Although not as yet recorded from Australia, owing to the recent publicity given to this insect and the possibility of its introduction, the writer has thought it desirable to include it in the list. At present it seems to be confined to the Punjab, India, where it has been recorded* as a very active agent in damaging stored wheat. The insect, which belongs to the family *Dermestidæ*, does not attack wheat in the adult stage, the damage being entirely caused by the larvæ, which gnaw away the pericarp of the grain, giving it a whitish appearance. The larvæ are most prevalent at the top of the grain, the greatest amount of damage always occurring in the first six to twelve inches. Unlike the previous species, all the material gnawed from the grain is consumed, and no floury matter becomes mixed with the grain, as is the case in the other species. A quantity of dust is produced, but this is entirely excrement. The adult beetle is a small, active, brownish-black insect, not much longer than broad, but the head small. The head, thorax, and tips of the elytra are dark brownish-black.



The Caddle (*Tenebroides mauritanicus*).

Saw-toothed Grain Beetle (*Silvanus surinamensis*).

A Rust Red Beetle (*Tribolium ferrugineum*).

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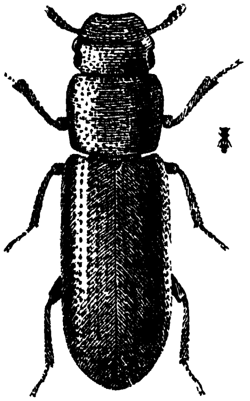
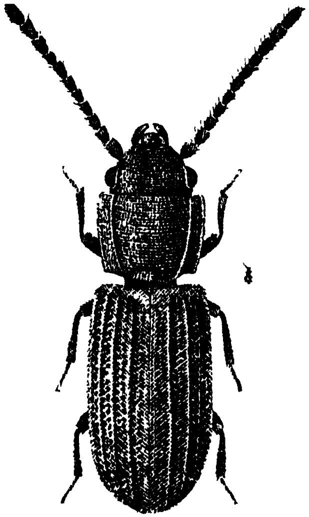
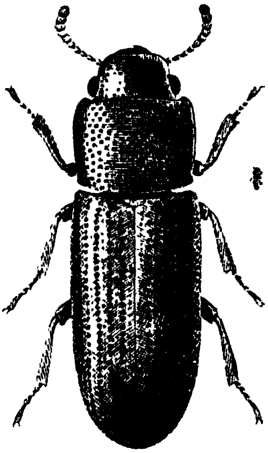
*Barnes (J. H.) and Grove (A. J.) The insects attacking stored wheat in the Punjab, and the methods of combating them. Memoirs of the Department of Agriculture in India, Chemical Series, Vol. 4, No. 6, Nov. 1916. Agric. Research Ins., Pusa.

The Saw-toothed Grain Beetle (*Silvanus surinamensis*, Linn.).—One of the commonest cosmopolitan insects, which habitually abides in cereals, preserved fruits, nuts, and seeds of all kinds. It is common in Australia in stored foodstuffs, and was also found in the wheat stacks. It was not, however, responsible for damage worthy of notice. The adult insect is of a dark-brown colour, and is easily recognised by the six saw-like teeth on each side of the thorax.

The Caddle (*Tenebroides mauritanicus*, Linn.).—This beetle has been widely distributed by commerce, and is most often found in cereals and nuts. For a considerable time some difference of opinion existed as to the nature of its food, but it is now definitely stated to attack the embryo of the grain, thus doing much damage if the parcel is required for seed purposes. It possesses, however, the good trait of also feeding on other injurious grain insects. It was found in limited numbers in the wheat stacks, but was not regarded as doing any damage.


Long-headed Flour Beetle (*Latheticus oryzæ*).


Flat Grain Beetle (*Læmophloeus minutus*).

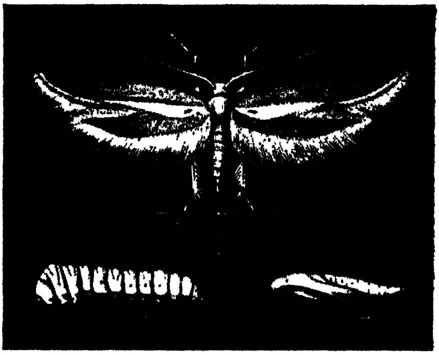

Palorus subdepressus.

Flour Beetles.

A Rust Red Flour Beetle (*Tribolium ferrugineum*, Fab.).—Although found practically wherever grain is stored, it has been definitely proved that this insect is not an active agent in destroying sound grain, but is in reality a "flour" beetle, living on grains damaged by other insects or in the dust and frass produced by their attacks. It is a cosmopolitan species, and, besides being found in stored grain, it is an important pest of stored foodstuffs, nuts, &c. World-wide in distribution, it has a wide range in Australia, where it was common in the wheat stacks, doing considerable damage.

The Long-headed Flour Beetle (*Latheticus oryzæ*, Waterh.).—This is very closely allied to the preceding species, and very similar to it in habits generally. It appears, however, to be less widely distributed, and consequently has not received so much attention. Barnes and Grove have recorded it as being "fairly common" in the wheat stores of the Punjab, India, in 1916. It was recorded for the first time in Australia from Enfield, New South Wales, in 1918, when it was very common in the wheat stacks at that place. It differs from the Red Rust Flour Beetle (*T. ferrugineum*) in being pale yellow in colour, and also by its curious antennæ. Although similar in general form to the preceding species, it is somewhat narrower, with the head relatively larger and broader and more square in general outline. Being a flour beetle, it is not capable of attacking sound grain, but in association with the insects mentioned under the heading of grain beetles it is capable of doing much damage.

The Flat Grain Beetle *Lœmophloeus minutus*, Steph.).—This is another flour beetle commonly met with in stored grain, feeding in the dust and frass produced by other insects, and also in dried fruits, nuts, and other foodstuffs. As a pest of stored grain in Australia it is of little importance, although having a wide range. Like the other insects listed, it is a cosmopolitan species. The adult is a small, reddish-brown, flattened beetle, with the antennæ filiform.



Angoumois Grain Moth (*Sitotroga cerealella*). Moth, Larva and Pupa.

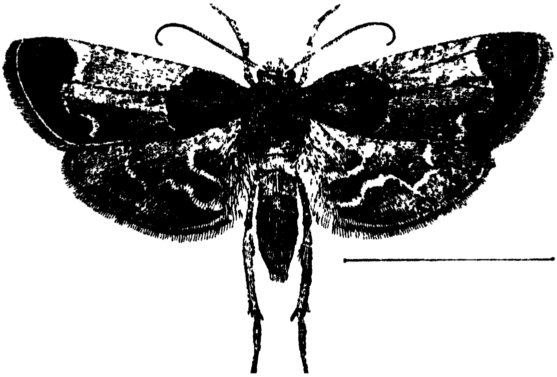
Palorus subdepressus, Woll.—No common name is at present in use for this species, about which nothing much is known. Although in general form and colour it resembles the Rust Red Flour Beetle (*T. ferrugineum*), it can be distinguished from the latter by the prothorax being broader in front than the abdomen, and more moderately and deeply punctured, and by the antennæ not being definitely clubbed, but gradually widening towards the tip. It is a cosmopolitan species, originally found under the bark of trees, but now also found in granaries, bakehouses, ground nuts, &c. Its range in Australia appears to have been restricted, and thus it was of no importance as a pest.

The Square-necked Grain Beetle (*Cathartus adrena*, Waltl.).—Another widely-distributed beetle, found in limited numbers in the Australian wheat stacks. Besides grain, it feeds upon a great variety of stored products, but it rarely becomes troublesome, and was of no importance as a pest in the wheat. The adult is a reddish, small, brown beetle, with a thorax almost square, and nearly as broad as the abdomen.

Grain Moths.

Angoumois Grain Moth (*Sitotroga cerealella*, Oliv.).—A cosmopolitan grain pest of great importance, in this respect even rivalling the grain weevils (*Calandra*). It is widely distributed throughout Australia, but only appeared in limited numbers in the wheat stacks, where it did but little damage. All the damage to the grain is done during the grub stage. The young grub effects an entrance into the grain through a crack or abrasion in the pericarp, and remains inside until ready to emerge as an adult moth. The latter measures about half an inch across the outspread wings, which are quite narrow, and heavily fringed with hairs.

The Meal Snout Moth (*Asopia farinalis*, Linn.).—A cosmopolitan moth, the larvæ of which subsists chiefly on cereals in different forms, but it is also found in other seeds, dried plants, &c. The larvæ live in long tubes and tunnels, composed of silk and particles of food material, in which it is living. Although common in the wheat stacks, it confined itself to the waste wheat and the more obscure parts of the stack, where the absence of light and the damper atmosphere seem to favour its development. The adult moth has a wing expanse of about one inch, with the wings prettily marked with grey and reddish brown, forming a definite pattern.



Meal Snout Moth (*Asopia farinalis*).

The Indian Meal Moth (*Plodia interpunctella*, Hbn.).—A very widespread species, that feeds upon grain, whether ground or whole. It is also very commonly met within dried fruits, nuts, &c., in which it does much damage. Although said to be common in Victoria, it was not so on the New South Wales wheat stacks, and as a pest did not, therefore, assume any importance. The adult moth has a wing expanse of a little over half an inch, but the outer two-thirds of the fore-wing is reddish brown with a coppery lustre, the inner portion and the hind wings dirty grey.

Insects of Doubtful Habits.

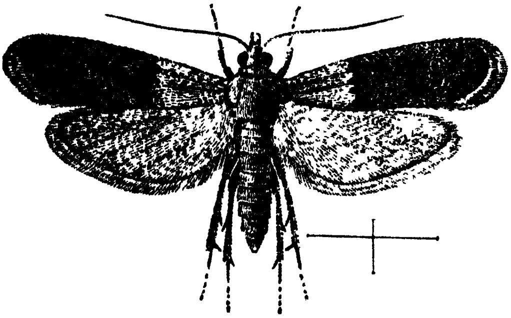
Alphitobius piceus, Oliv.—This beetle was only occasionally found, in wheat that had become damp or mouldy. It does not attack the grain, and is probably a scavenger beetle. The adult is a relatively large black beetle, about a quarter of an inch in length.

Cryptophagus sp.—This is a small beetle belonging to the obscure family *Cryptophagidæ.* The nature of its association with stored wheat is obscure, but it is believed to feed on moulds of various kinds. It occurred only in limited numbers.

Remarks.

From the foregoing list it will be noted that the insects are mainly beetles, and that only two insects—the Lesser Grain Borer (*R. dominica*) and the Common Grain Weevil (*C. oryzæ*)—were responsible for the bulk of the damage in Australian wheat. In the Punjab, India, a third species—the Khapra beetle (*T. khapra*)—has been added as doing serious damage. These three species, together with the others included under the heading of "grain beetles," are all capable of attacking sound grain, and hence may be known as "primary attackers."

With regard to those species under the heading of "flour beetles," they are not active agents in the destruction of sound wheat, but live in both larval and adult stages on grain damaged by other insects, and in the dust or frass produced by their attacks, and hence may be known as "secondary attackers." They were, nevertheless, responsible for considerable damage, in so far that they helped to complete the destruction commenced by the other insects. In this respect the Rust Red Flour beetle (*T. ferrugineum*) and the Long-headed Flour Beetle (*L. oryzæ*) were by far the most destructive of the group.



Indian Meal Moth (*Plodia interpunctella*).

Although rivalling the two grain weevils (*Calandra*) as granary pests, the Angoumois grain moth (*S. cerealella*), together with the other grain moths—the Indian Meal Moth (*P. interpunctella*) and the Meal Snout Moth (*A. farinalis*)—played but a very limited part in the destruction of the wheat. The two first mentioned were but little noticed in the New South Wales stacks, although the Indian Meal Moth (*P. interpunctella*) was said to be common in the Victorian stacks. The Meal Snout Moth (*A. farinalis*) was more plentiful, particularly at Enfield, but only in the damp waste wheat, and in the least exposed parts of the stacks, where the conditions were more favourable for its development.

Farmers' Experiment Plots.

J. M. PITT, Assistant Inspector of Agriculture.

Trials with Mangels at Mount George.

A VARIETY trial with mangels was conducted during 1921 on the farms of—

J. C. Duff, Mt. George,
W. Pemberton, Mt. George.

The season was remarkable for the extremely heavy rainfalls, but notwithstanding the fact that nearly 50 inches of rain fell between March and December the crops, other than in depressions here and there, were unaffected. In fact, the continuous supply of moisture and the richness of the soil, no doubt, were important factors in the harvesting of such excellent yields.

Both plots were sown in well prepared seed-beds during March. The land had previously grown straw crops, and after lying in fallow for a month or two was carefully and thoroughly worked, the resulting seed-bed being fine, firm, clean, and moist—all important considerations for successful mangel growing.

Having only small areas to sow, the seed was soaked in cold water the night previous. This method and the sowing in moist soil (¾ to 1 inch in depth), together with a rain which fell afterwards ensured a good germination. Soaking is rather risky where large areas are to be sown, owing to the probable loss of seed. It is not advisable to keep soaked seed for more than twenty-four hours, and in any case it must be sown in moist soil. Further, it can only be sown evenly by hand—a tedious operation over a large area.

Small ridges were made 3 feet apart with a Planet Jr. cultivator with side attachments. After-cultivation consisted of hand-weeding once or twice in the rows, and the use of the cultivator at different intervals to keep the surface soil loose and to destroy weed growth. The success of the crop depends largely upon whether the field is neglected or is tended carefully. When about 4 to 6 inches high the plants were thinned out to 6 or 8 inches apart. During August and early September a further thinning to 12 or 18 inches apart was given, the thinnings making useful pig-feed. The mature crop was used chiefly for pig food, as the experimenters only carried on dairying in a small way.

Of the varieties tried on Mr. Pemberton's farm Mammoth Long Red gave the heaviest yields throughout. This variety has for many years been a reliable and consistent yielder. The roots are tall, many standing over 2 feet above ground level and running up to 40 lb. in weight. One specimen, grown by Mr. Duff, attracted unusual attention at Taree show. Giant Halfsugar (white) yielded best of the other varieties. This also is a tall-growing variety. The yellow sorts yielded comparatively lightly, although there were some good individual roots. The seed of many of these varieties was rather mixed.

Mammoth Long Red and Champion Yellow Globe were the pick on Mr. Duff's farm. The yields of the former on the outside section were much affected by adjoining crops.

Variety.	Yield per Acre.				Percentage Yield.
	t.	c.	q.	lb.	
Mr. W. Pemberton's Plot.					
1. Mammoth Long Red (*check*)	45	15	2	14	100
Yellow Globe	29	9	1	4	62
Golden Globe	24	18	3	20	51
2. Mammoth Long Red (*check*)	49	13	3	20	100
Sugar Mangels	32	12	0	16	70
Mammoth Long Red (imported seed)	41	12	3	12	96
3. ,, ,, ,, (*check*)	40	1	1	20	100
Giant Halfsugar (white)	48	18	1	20	Percentage yields not estimated*
,, ,, (rose)	37	18	0	24	
Giant Intermediate	25	10	2	24	
4. Mammoth Long Red (*check*)	36	14	2	16	
Golden Yellow Mammoth	23	11	1	20	
5. Mammoth Long Red (*check*)	46	7	0	16	
Mr. J. C. Duff's Plot.					
	t.	c.	q.	lb.	
1. Mammoth Long Red (*check*)	25	6	3	24	Influenced by saccaline crop.
Golden Yellow Mammoth	25	10	2	24	
Prizewinner	20	16	1	20	
2. Mammoth Long Red (*check*)	38	10	0	0	
Yellow Globe	18	17	0	16	
Mammoth Long Red (imported seed)	48	6	1	20	
Champion Yellow Globe	39	5	2	24	
3. Mammoth Long Red (*check*)	Not weighed; influenced by adjoining crop.				

* Check plot No. 4 was influenced by outside conditions.

The excellent yields were no doubt due to the fertile soil and the favourable rainfall throughout. It is doubtful whether such a return could be harvested from any other farm crop.

Considering that mangels are so widely known and grown in other lands, it seems remarkable that there are practically none grown on the central coast, where the conditions for their successful culture are ideal, and where dairying and pig-raising are the main industries. The reason is, probably, that other fodder crops, such as maize, sorghum, pumpkins, and pasture crops are produced with so little labour that a crop requiring extra care and attention remains an unknown quantity. As a fodder for pigs especially, and also for dairy cattle, mangels have a world-wide reputation, owing to their succulence, palatability, and relatively high food value.

Their storage qualities are not nearly as good under warm, moist, coastal conditions as in colder districts, but their availability extends over several months.

Trials with Peas on the Manning.

A variety trial with peas was conducted on the farm of Mr. R. Dyball junior, Taree Estate, Manning River, during the winter and spring of 1921. While being a slight divergence from the usual run of farmers' experiment plots, the trial will no doubt be the forerunner of many others dealing with vegetable crops.

The Manning River district, by reason of its large expanse of rich alluvial lands, its sub-tropical warmth, and abundance of moisture (the latter more often bordering on the excessive than the other extreme), has been well favoured by nature in the essentials to successful cropping. In spite of these all-important advantages, it has not been until recent years that an "awakening" has come about in the matter of vegetable production, the majority of townspeople, and even farmers themselves, relying on supplies mainly from John Chinaman, or on shipments from distant regions (which usually arrived in anything but a fresh condition), or else following the lesser line of resistance, and doing without. At all events, a considerable amount of money was sent out of the district which might reasonably have been kept within its bounds.

This state of affairs has now completely changed. Under the influence of increasing population, the war, and other things, the cultivation of vegetables has increased rapidly in the past few years—commencing first in kitchen gardens, and then extending to larger areas—until to-day Taree boasts of a supply of fresh vegetables perhaps not equalled anywhere. Union sales have been established and have developed in a marked degree, and many farmers now have under continuous vegetable culture as many acres as they previously had rows, and are finding that the occupation, even if requiring a little more work, is interesting. Above all, the monetary returns from half an acre are at least equal to that obtained from three or four acres or more under ordinary farm crops.

Although experimental work of a sort has been done here and there by farmers themselves, very little information of value is available for the majority of growers. The chief object of carrying out future trials should be to overcome this, and from time to time to afford data dealing with the behaviour of varieties, times of sowing, cultural requirements, manurial returns, &c. In the case of the present experiment with peas, a fall of rain shortly after sowing, amounting to over 4 inches, somewhat spoiled the germination. It was not advisable to publish the yields, but a considerable amount of useful data was carefully collected, which should prove of interest. The varieties tried were obtained by the Department from leading seedsmen, and the plot was sown on 17th June, 1921, on a rich, loamy portion of land, representative of many hundreds of acres in the neighbourhood. It was originally intended to sow in May, but rain interfered with the preparation of the land.

Union Jack and Sherwood were tried independently by the farmer, but were poorish.

Variety and Order of Maturity.	First Peas fit for market.	Approximate Time in weeks.	Cropping Characteristics.	Size of Pod and Average Number of Peas.	Habit of Growth, and Height under Field Conditions.
Little Marvel ...	Third week September	14	Apparently only suitable for one picking; very few flowers present.	Pods large, well filled; average 6 peas; large, even sized.	Dwarf, 12 to 16 inches.
Magnet	Last week September.	14½	Fair first picking; continuous cropper; flowers plentiful.	Pods small; average 6 peas; medium size.	Dwarf, 15 inches.
Bountiful (late Temperley Wonder)	Last week September.	14½	First crop good; continuous cropper, but not heavy.	Pods long; well filled; average 7, all large.	18 inches.
Richard Seddon ...	First week October	15	Fair first picking; continuous bearer.	Pods medium size; plump, full; average 7; large.	Dwarf, 12 inches.
William Hurst ..	First week October	15	First picking very sparse; later pickings very good; continuous cropper.	Pods narrow, long tip, bent back: large, average 7 peas.	Dwarf, 12 inches.
Greenfeast . ..	First week October	15	Good first picking; continuous bearer; flowers plentiful.	Pods narrow, long, bent back, well filled: average of 9 large, even-sized peas.	Dwarf, 15 inches.
Senator	First week October or slightly later.	15¼	Good first picking; continuous bearer.	Pods large, not well filled; 4 to 6 large and medium sized peas.	Dwarf, 15 inches.
Daisy ...	Second week October .	15½	Good first picking; continuous bearer,	Pods large and well filled; average 7 large peas.	Dwarf, 15 inches.
Witham Wonder .	Second week October..	15½	Good first cropper; continuous bearer.	Pods medium sized, curved, well filled; average 7, large and even peas.	Dwarf, 15 inches.
Yorkshire Hero .	Second week October	16	Good first picking; continuous bearer.	Pods medium sized and deep, not well filled; average 4 to 6 uneven sized peas.	18 inches to 2 feet.
Stratagem	Third week October .	16½	Good first cropper; continuous bearer.	Pods large, well filled; average 8 fairly even sized peas.	18 inches to 21 inches.
Peerless ..	Fourth week October...	17	Sparse first picking; but very poor later; continuous cropper.	Pods large and deep; averaging 8 peas, large and even.	18 inches to 2 feet.

On the season's performances the outstanding variety was Greenfeast, a continuous cropper that produces long well-filled pods. Others in order of preference were William Hurst, Senator, and Peerless. Mr. Dyball places the varieties in the following order, basing his conclusions mainly on outstanding yielding capabilities, earliness (thus securing the early market and higher prices), continuous cropping characteristics, and well filled saleable pods:—First, Greenfeast; second, William Hurst and Senator; third, Temperley Wonder, Peerless, and Daisy; fourth, Yorkshire Hero.

Such a classification is different from the usual popular fancies, and at least justifies the carrying out of the experiments and the continuation on similar lines in the future.

BUREAU CONFERENCE AT PARKES.

THE second annual conference of the branches of the Agricultural Bureau in the western district will be held at Parkes on 27th and 28th April.

Mr. G. Henderson, Strathnoon, Borenore, the convening secretary, has completed arrangements for the conference, and the following are the proposed features of the programme:—

Address of welcome, by the Mayor of Parkes.
Opening address, by Sir Joseph Carruthers.
"A National Scheme for the Conservation of Fodder," lecture by Mr. W. E. Tayler, Adavale, Parkes.
"Woman's Life on the Farm, and Rural Hygiene," lecture by Dr. Mary Booth.
"The Rural Bank of New South Wales," lecture by Mr. James King, of Rural Bank, Sydney.
"Wheat," lecture by Mr. A. H. E. McDonald, Chief Inspector of Agriculture.
Free parliament for discussion of motions submitted by branches.

A tour of inspection of farms in the Parkes district will round-off the schedule. A cordial invitation to attend the conference is extended to farmers, irrespective of whether they are members of a branch of the Bureau or not.

ABATTOIR REFUSE USELESS AS BLOW-FLY BAIT.

THE possibility of some of the waste products of the abattoir being useful as bait for the traps for sheep-maggot flies has lately been considered by the Department, and trials with dessicated liver, dried blood, meat meal, and meat soup have been conducted at Nyngan and Trangie Experiment Farms. The experience at both farms showed that none of the mixtures are of any special value for baiting blow-fly traps The only one that attracted the fly was dried meat, dissolved in water. Gut slime has been used in America, and is there claimed to be the best bait, but it has proved of no value in this State, and the Department has, therefore, to revert to the use of meat, livers, &c. So far no dried mixture, such as might be tinned and made available in that form, has been found.—W. W. FROGGATT, Government Entomologist.

Importations of Stud Stock.

ACTING upon the instructions of the Hon. W. F. Dunn, M.L.A., Minister of Agriculture, Mr. J. A. Robertson, Herdmaster of the Department, visited New Zealand early in the present year for the purpose of purchasing a few Clydesdale horses to strengthen the stud at North Bangaroo Horse Stud Farm. and also some cattle and pigs if suitable animals were available.

One stallion and two mares (one with foal at foot) were secured by Mr. Robertson and were landed at Sydney in March, their arrival being a matter of considerable interest. The purchase, though not a large one, introduces lines of blood that have acquired an excellent reputation in New Zealand, and is sure to be a source of strength to the stud at North Bangaroo. A Jersey bull (which will be on exhibition at the Sydney Royal Show) and three Middle Yorkshire pigs (for location at Bathurst) were also procured.

The following particulars with regard to the horses will be read with interest:—

(I) Clydesdale Stallion.

HIGH HONOUR (N.Z. 902)

Sire, King of Honour (N.Z. 264) (imp.), by Everlasting (11,331); dam, White Silk (N.Z. 345) (imp).

High Honour, who is half brother to the unbeaten show mare Black Silk, is six years old, a good specimen of the modern Clydesdale, stands 17·2 hands high and has white points. His past season was a heavy one and he is somewhat out of condition, but he has already shown his ability to get good stock, and sired the unbeaten colt and filly in this season's South Island shows. He was bred by Mr. J. W. Harding, of Hawkes Bay, and was latterly in the stud of Mr. James Patrick, of Outram, near Dunedin.

(II) Clydesdale Mare.

BESSIE LEA (1,672).

Sire, Buchlyvie Favorite (imp.); dam, Black Rose.

Bessie Lea is a five-year-old, dark brown, with white feet. She stands 17 hands high and is of great size and substance, and has had a splendid show record, particularly in the North Island. She is stinted to Baron Bold (imp.),*a stallion with a notable record in New Zealand, both in the show-ring and at the stud.

(III) Clydesdale Mare.

MARY OF CROFTHEADS (imp.)

This is also a shapely mare of the modern Clydesdale type, having been imported from Scotland to New Zealand. She stands 16·2 hands high, is a dark bay, with white feet, and is now eleven years old. Her show record in

Otago has shown her to be of sound quality, and she foaled a colt that was first as a two-year-old at four South Island shows. At foot she has a promising dark brown colt foal by Baron Bold (imp.), and is stinted again to the same sire.

(IV) Jersey Bull.

ASTER'S DIAMOND KING (10,374 N.Z., J.H.B.)

Sire, Bright Aster (963, N.Z., J.H.B.); dam, Squire's Vanity (9,164, N.Z., J.H.B.), by Cherry's Squire.

This is a young bull (which may also be conveniently mentioned here), who gained first prizes as a yearling. His dam (off the grass only) produced over 847 gallons of milk and 565 lb. of butter in 365 days as a two-year-old.

PERFORMANCE VERSUS PEDIGREE.

So convinced is the Danish Government of the value of performance as distinct from pedigree, says a recent issue of the *Journal of the Ministry of Agriculture* (London), that in making provision for the award of special prizes for bulls, it was laid down that a bull is not eligible for a Government prize unless records of the performances of his daughters can be produced. The journal quotes the informative statement that "before the inauguration of milk-recording societies it had already become a general practice to keep bulls for service for a number of years, and *to judge the bulls by an examination of their offspring.*"

A NEW PROCESS OF SEED PREPARATION.

A METHOD of cleaning and grading seeds and grain has been invented and patented by E. E. Eddy, formerly Chief Seed Inspector of the Canadian Department of Agriculture. The separation is made entirely on the basis of comparative specific gravity. This is effected by subjecting the stock to centrifugal action in the presence of a liquid which is of the specific gravity required for the separations desired.

A suitable material for making a liquid of the desired density is sodium nitrate, but other substances may be used. With seeds weighing about 60 lb. per measured bushel, such as lucerne and clovers, a solution of about 1·2 specific gravity is required. By regulating the density of the liquid, the proportion of seeds which pass into the heavy and light separations is under complete control.

Tests of several samples of red clover showed a perfect separation of several kinds of the most common weed seeds classed as noxious. Almost equally valuable were the results in reducing the less harmful species. Tests so far have been made mostly with small seeds. It is expected, however, that valuable results will be secured also with grains by removing barley and oats from wheat, oats from barley, &c., in addition to the separation of weed seeds.

Top-dressing of Pastures.

EXPERIMENTS AT GLEN INNES EXPERIMENT FARM.

E. BREAKWELL, **Agrostologist.**

TOP-DRESSING of pasture experiments, consisting of trials over a period of three years of different fertilisers applied to plots containing a mixture of introduced grasses and cow grass clover, were inaugurated at Glen Innes Experiment Farm in 1919. The mixture was sown in April on a block comprising four-fifths of an acre, Kentucky blue grass failing to germinate, however. The area was divided into four equal sized plots. It was top-dressed with fertilisers in July, 1919, as follows:—

Plot 1.—150 lb. nitrate of soda, 75 lb. sulphate of potash, and 75 lb. superphosphate, per acre.
Plot 2.—150 lb. nitrate of soda, and 75 lb. superphosphate, per acre.
Plot 3.—75 lb. sulphate of potash, and 75 lb. superphosphate, per acre.
Plot 4.—No manure (*check*).

The First Year.

The first observations were recorded on 5th December, 1919, in the following manner:—Five equal four-foot squares were pegged out in each plot, and a wire frame of the same size, consisting of sixty-four equal divisions, each division a six-inch square, was constructed. By placing the wire frame in the pegged-out squares it was possible to map out the areas covered by the various plants. The total weight of grass and clover from each square was then weighed. The results were as follows —

Plot.	Average percentage of space covered by pasture.	Average percentage of space covered by individual grasses and red clover.		Average weight of pasture from each square
1	40	Perennial rye	25	1 lb. 14 oz
		Clover	10	
		Cocksfoot	3	
		Phalaris bulbosa	2	
2	40	Perennial rye	30	1 lb. 12 oz.
		Clover	8	
		Cocksfoot	1	
		Phalaris bulbosa	1	
3	55	Perennial rye	25	1 lb. 12 oz.
		Clover	20	
		Cocksfoot	5	
		Phalaris bulbosa	5	
4	40	Perennial rye	20	1 lb. 6 oz.
		Clover	10	
		Cocksfoot	5	
		Phalaris bulbosa	5	

The Second Year.

A second top-dressing was applied in August, 1920, at the same rate, and observations were recorded on 7th October, with the following results:—

Plot.	Average percentage of space covered by pasture.	Average percentage of space covered by individual grasses and clover.		Average weight of pasture from each square.
1	60	Perennial rye ...	35	2 lb. 12 oz.
		Clover	15	
		Cocksfoot	5	
		Phalaris bulbosa ...	5	
2	65	Perennial rye ...	35	2 lb. 12 oz.
		Clover	20	
		Cocksfoot	8	
		Phalaris bulbosa ...	2	
3	70	Perennial rye ..	30	2 lb. 13 oz.
		Clover	35	
		Cocksfoot	4	
		Phalaris bulbosa	1	
4	50	Perennial rye ...	20	1 lb. 12 oz.
		Clover	25	
		Cocksfoot	2	
		Phalaris bulbosa ...	3	

Later in the year, Mr. L. G. Little, Experimentalist, recorded the following observations:—

The outstanding feature was the almost immediate response of the rye grass to the nitrate of soda dressing. In both nitrate plots the early growth was mostly rye grass, and within a fortnight it was some inches taller than the surrounding divisions. Hardly any difference was noticeable between plots 1 and 2. Rye grass predominated in each, and the clover was also vigorous in both plots.

Plot 3 was distinctly different. Its early growth was slightly behind that of plots 1 and 2, but it made a greater bulk growth, and was in succulent condition for nearly a fortnight longer. The growth of clover was very vigorous, and with the rye grass was predominant, as the other grasses were not noticeable. Plot 4 was generally slower than and inferior to the other plots; yet, owing to the excellent season, it made a nice growth.

Circumstances prevented the cutting and weighing of greenstuff for comparative yields, and the whole area was cut in a half-dry condition on 30th December. After this cut (to which the above notes apply), growth was generally at a standstill until March. The growth resulting during April and May from the March rains was fair, and similar in all plots. The plots were grazed during this period. Cocksfoot and *Phalaris* were now prominent.

The Third Year.

In the third year, the top-dressing was applied in August, and observations were recorded on 29th November. It was found that the growth was so dense, and the plants so entangled, that to determine the space occupied by individual plants was impossible. The plants were divided into their respective classes after cutting, and each lot of grass and clover weighed. All the space was occupied by pasture. The results were as follows:—

Plot.	Average weight of Clover from each square.	Average weight of Perennial Rye Grass from each square.	Average weight of Cocksfoot from each square.	Average weight of *Phalaris bulbosa* from each square	Average total weight of pasture from each square.	Weight of pasture per acre taken from cutting one-tenth acre.
	lb.	lb.	lb.	lb.	lb	t. c. q.
1	2¼	1½	½	¼	4½	4 16 0
2	2	2	½	¼	4¾	5 4 0
3	3½	1¼	¼	Trace.	5	5 14 3
4	½	1¼	Trace.	Trace	1¾	1 18 3

Mr. Little forwarded the following note on this year's cut.—

The plots were cut on 9th December, 1921, with the mower, and an area of one-tenth acre each was weighed on plots Nos. 1, 2, and 3, and one-twentieth acre on plot 4. At the time of cutting, the growth was dense, and between 2 and 3 feet high, and at an excellent stage for the making of first-class meadow hay. Some trouble was experienced in getting the mower to cut all the crop, particularly in the nitrate plots where rye grass predominated. Here a stubble about 4 inches long was left while the superphosphate and potash plot (No. 3) cut cleaner, and with slightly less stubble, except where the clover had lodged and the mower failed to pick it up. The material was weighed immediately after cutting.

The results show that 2 or 3 tons of high-class meadow hay may be produced by the application of the fertilisers as a top-dressing, and the pasture would be available for grazing immediately the hay was stacked. In addition to the hay, it should be able to support two sheep to the acre for the rest of the summer. The stubble left on the unmanured plot was far inferior to that on the manured ones

Conclusions.

1.—The application of fertilisers to introduced grasses on the class of soil at Glen Innes is distinctly beneficial, resulting in a considerable financial gain.

2.—Superphosphate and sulphate of potash appear to be as beneficial, if not more so, than the complete manure which includes nitrate of soda.

3.—It is impossible to determine whether the slight increase in plot 3 is due to the superphosphate or sulphate of potash.

4.—The application of sulphate of potash and superphosphate results in a remarkable increase in the clover over the grasses, a result which confirms the experience in other countries.

5.—The complete manure, including nitrate of soda, appears to result in a more balanced proportion of legumes and grasses.

List of Fertilisers in New South Wales.

F. B. GUTHRIE, A. A. RAMSAY, R. M. PETRIE, AND F. J. STOKES.

1922 List.

THE accompanying list of manures obtainable in New South Wales, together with their composition, as guaranteed by the vendors, is the result of the revision of the list issued in April, 1921.

The list is published in the interests of the farmers, and it is hoped that it may serve as a guide to those requiring any particular class of manure.

It must be clearly understood that the figures given are not those obtained by analysis of the sample by the Department. They represent the *guarantees* given by the vendors in accordance with the provisions of the Fertilisers Act. Where possible, samples have been taken from bulk by one of the officers of the Department, and purchasers may be confident that the manures included in the list are up to the guarantee.

On account of the unsettled conditions obtaining at present, the market value of these manures may alter. An attempt has, however, been made to assign a "unit value" to the fertilising ingredients, viz., nitrogen, phosphoric acid, and potash, as in pre-war years.

A word is necessary in explanation of the column giving the "manurial value" of the manures. These figures are calculated from the composition of the manures and the market prices then current, a definite unit-value being assigned to each of the fertilising ingredients. The units on which the values given are computed are as follows:—

UNIT-VALUES of fertilising ingredients in different manures for 1922.

	Per unit.	
	s.	d.
Nitrogen in nitrate	29	1
,, in ammonium salts	19	10
,, in blood, bones, offal, &c.—fine	22	11
Phosphoric acid in bones, offal, &c.—fine	6	7
Phosphoric acid (water soluble) in superphosphates	7	7
Potash in muriate of potash	12	9
,, ,, sulphate of potash	12	2*

PRICE per lb. of fertilising ingredients in different manures for 1922.

	Pence per lb.
Nitrogen in nitrate	15·6
,, in ammonium salts	10·2
,, in blood, bones, offal, &c.—fine	12·3
Phosphoric acid in bones, offal, &c.—fine	3·5
Phosphoric acid (water soluble) in superphosphates	4·1
Potash in muriate of potash	6·8
,, ,, sulphate of potash	6·5*

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*The Australian Fertilisers Proprietary, Limited, will reduce the unit-value to 8s. 1d. as from April, with a further reduction in August. The cost per lb. will be proportionately reduced to 4·3d. per lb.

To determine the value of any manure the percentage of each ingredient is multiplied by the unit-value assigned above to that ingredient, the result being the value per ton of that substance in the manure. For example, a bonedust contains 4 per cent. nitrogen and 20 per cent. phosphoric acid :—

4 × 22s. 11d. = £4 11s. 8d. = value of the nitrogen per ton.
20 × 6s. 7d. = £6 11s. 8d. = ,, phosphoric acid per ton.

£11 3s. 4d. = value of manure per ton.

It must be clearly understood that the value thus assigned, depending solely upon the chemical composition of the manure, does not represent in all cases the actual money value of the manure, which depends upon a variety of causes other than the composition, and is affected by local conditions; neither does it represent the costs incurred by the manufacturer in the preparation, such as cost of mixing, bagging, labelling, &c. It is simply intended as a standard by which different products may be compared. At the same time, it has been attempted to make the standard indicate as nearly as possible the fair retail value of the manurial ingredients, and it will be found in the majority of cases the price asked and the value assigned are fairly close.

These figures have been checked by analyses of samples collected by an officer of the Department. It by no means follows, however, that the particular product guaranteed and here published will be in stock for any length of time or that the prices may not vary.

Now that the Fertiliser Adulteration Act is in force, the purchaser has only himself to blame if he pays for an inferior article. Every vendor is obliged to furnish a guarantee with every delivery of fertiliser, setting forth its actual composition as determined by analysis.

If the purchaser has any reason to suspect the genuineness of the guarantee, all he has to do is to notify the vendor of his intention to take samples for analysis, in sufficient time to enable the vendor or some person appointed by him to be present. The samples must be taken before the consignment is finally in the purchaser's possession; for example, if the fertiliser is sent by rail, the sample should be taken at the railway station or siding. Three samples must be taken, one being given to the vendor or his representative, the second kept by the purchaser and submitted to an analyst, and the third forwarded to the Department of Agriculture for future reference, in case of divergence in the analyses of the other two. All three samples must be sealed up.

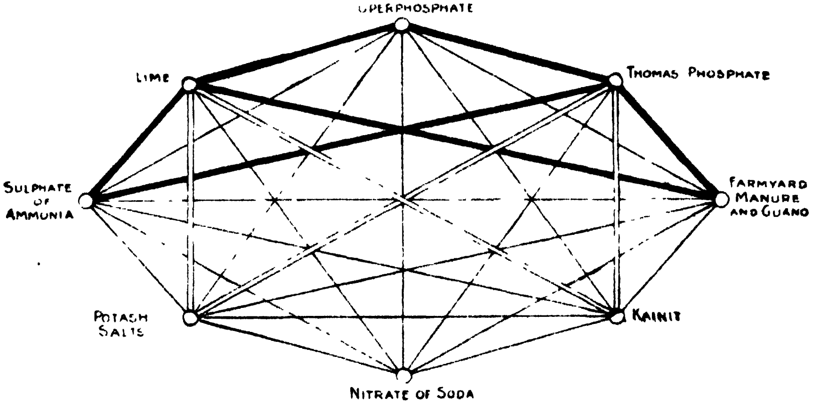
In the case of bonedust, blood and bone manures, &c., the valuation has been made on the assumption that the product is in a fine state of division, and is based on the amounts of fertilising ingredients only; but it must be borne in mind that finely-ground bonedust acts more rapidly than coarse, and that unground fragments of bone only become available as fertiliser very slowly.

A number of waste products which may in many cases be economically utilised have been analysed in the laboratory at various times. The results of those analyses appeared in this *Gazette* in April last year.

When purchasing a manure, always insist on a guarantee of its composition as determined by the analysis.

Never add lime to a manure containing sulphate of ammonia or blood and bone manures, as in these cases loss of nitrogen results ; and when lime has been applied to the land, do not use such manures until about three weeks afterwards.

The accompanying fertiliser diagram, which represents in a graphic manner the points to be taken into consideration in the mixing of different manures, is reproduced in the hope that it will be found useful to farmers who make up their own mixtures.



Substances connected by thick line must not be mixed together.
Substances connected by double line must only be mixed immediately before use.
Substances connected by single thin line may be mixed together at any time.

TABLE I.—SIMPLE FERTILISERS.

Manure	Where obtainable.	Guaranteed Composition.					Manurial Value		
		Nitrogen.	Equal to Ammonia.	Lime.	Potash.	Phosphoric Acid.			
		per cent.	per cent.	per cent.	per cent	per cent	£	s	d.
Sulphate of ammonia	Australian Fertilisers Proprietary, Ltd (successors to Geo. Shirley, Ltd , 7 O'Connell-street)	20·4	24·8				*20	4	7
Nitrate of soda	,, ,,	15·6	18·9				22	13	8
Muriate of potash	,, ,,				58	..	36	10	6
Sulphate ,, ,,	,, ,,				52		†31	12	8
,, ammonia	Australian Gaslight Co., Haymarket	20·4	24·8				20	4	7
,, ,,	Farmers' Fertilisers Corporation, 31 Hunter-st	20·4	24·8				20	4	7
Gypsum	,, ,, ,,			96 Cryst. $CaSO_4$					
Sulphate of potash	,, ,, ,,				52·7		32	1	2
Agricultural lime. (Burnt lime, air slaked).	,, ,, ,,								
Ground rock phosphate.	,, ,, ,,				..	31·95			
Sulphate of ammonia	Paton, Burns, & Co , 75 York st.	20·4	24·8				20	4	7
Muriate of potash	,, ,, ,,				52		36	19	6
Nitrate of soda	,, ,, ,,	15·6	19·1				22	16	7

* May be purchased at 17s. 8d. per unit or £18 per ton at producers' works.

† Australian Fertilisers Proprietary Limited will reduce price to 8s 1d. per unit or £21 per ton as from April. Further reductions after 1st August.

II.—BONE AND BLOOD MANURES, 1922.

Manure.	Where obtainable	Guaranteed Composition				Manurial Value.		
		Nitrogen.	Ammonia.	Phosphoric Acid.	Equal to Tricalcic Phosphate			
		per cent.	per cent.	per cent.	per cent.	£	s.	d.
Bonedust	Australian Fertilisers Proprietary Ltd (successors to Geo. Shirley Ltd.), 7 O'Connell-street	3·8	4·61	22 0	48·03	11	11	11
Bone and blood	,, ,, ,, ,,	5·0	6·07	17·0	37·11	11	6	6
B. and B. manure	Kitchen and Sons, Ltd , 365 Kent-st.	5·0	6·07	17·0	37·11	11	6	6
Extra B. and B. manure	,, ,, ,,	5·0	6·07	13·0	28·38	10	0	2
Blood and bone	R. S. Lamb & Co., 32 Jamieson-st.	4·12	5·0	13·74	30·0	9	4	10
Pure fertiliser	N.S.W. State Abattoirs, Homebush Bay	6·68	8 11	10·87	23·73	11	4	8
No. 1—General purposes bonedust	Wooster Fertilisers, Ltd., 16-20 Bridge-street	3·7	4 5	21·98	48·00	11	9	6
No. 2—Pure steamed bonedust	,, ,, ,,	3·91	4 75	24·50	53·50	12	10	11
No. 3—Blood and bone manure	,, ,, ,,	5·76	7·00	13 74	30·00	11	2	5
No. 5—Raw bonedust	,, ,, ,,	4·01	4·86	24·41	53·30	12	12	7
Blood	Riverstone Meat Co., Ltd., Riverstone	13·5	16·0	...	....	15	9	4
Blood and bone	,, ,, ,, ,,	4·75	5·77	20·00	43·66	12	0	6
Sandown blood and bone fertiliser	J. Cooke & Co., Propy., Ltd., Sandown Works, Parramatta.	6·85	8·32	11·40	25·50	11	12	0
Excelsior bonedust	M. Gearin and Sons, Old Botany road, Mascot	3·5	4·25	22·0	48·03	11	5	0
Bonedust	M. O'Riordan and Sons, O'Riordan-rd , Alexandria	3 7	4·5	21·98	48 0	11	9	6
Bone and offal manure	Newcastle District Abattoir Board, 27 Hunter-st	6·25	7·59	11·00	24·01	10	15	8
Dried blood	,, ,, ,, ,,	12 00	14·57	....	.....	13	15	0
Bonedust, B.D. 1	Paton, Burns, & Co., 75 York-st.	3·7	4·49	22·12	49·29	11	10	5
,, B.D. 2	,, ,, ,,	3·7	4 49	22·12	49·29	11	10	5
,, B.D. 3	,, ,, ,,	3·3	4 01	20·07	45 19	10	11	11
Bone and blood manure, B.B. 1	,, ,, ,,	5·0	6·07	17·00	37·11	11	6	6
,, ,, ,, B.B. 2	,, ,, ,,	5·0	6 07	13 00	28·38	10	0	2
Bone phosphate	,, ,, ,,	......	.....	29·77	64·99	....		
Dried blood	,, ,, ,,	13·00	15·79	....	......	14	17	11

III.—SUPERPHOSPHATES, MIXED FERTILISERS, AND IMPORTED FERTILISERS.

Manure.	Where obtainable.	Guaranteed Composition.				Manurial Value.		
		Nitrogen.	Water-soluble Phosphoric Acid.	Total Phosphoric Acid.	Potash.			
		per cent.	per cent.	per cent.	per cent.	£	s	d.
Superphosphate	Australian Fertilisers Proprietary Ltd (successors to Geo. Shirley, Ltd., 7 O'Connell-st.) ..	.. ...	17·0	......	.. ..	6	8	11
Basic Superphosphate ...	,, ,, ...	......	.... .	17·0	......	.....		
No. 2	,, ,, ...	2·0	10·0	. ....	1·0	*6	8	3
No. 4	,, ,, ...	4·0	8·0	......	2·0	*8	5	6
No. 5	,, ,, ...	3·0	10·0	... ..	7·0	*11	4	7
No. 6	,, ,, ...	3·0	10·0	......	4·0	*9	6	4
No. 8	,, ,, ...	4·0	11·0	.. ...	......	8	2	9
No. 10...	,, ,, ...	2·0	13·0	.. .	......	6	18	3
No. 11	,, ,, ...	......	12·0	.... .	4·0	*7	2	0
No. 1 Superphosphate	Farmers' Fertilisers Co-op., Ltd., 31 Hunter-st. ..	.....	17·0	...	... ..	6	8	11
No. 0 Phosphatic fertiliser	Wooster Fertilisers, Ltd., 16-20 Bridge-street	3·30	4·5	20·61	.....	11	15	10
No. 6 Potato ,, ...	,, ,, ...	4·52	3·0	14·19	5·0	13	1	5
No. 7 Complete ,, ...	,, ,, ...	5·01	4·0	14·56	2·0	11	12	5
Sulphide Superphosphate . . .	Gibbs, Bright & Co., 37 Pitt-street ...	... ..	17·0	......	... ..	6	8	11
Nitro ,, ...	,, ,, ...	1·6	15·0	. . ..	......	7	7	4
No. 1 Bone and ,, ...	,, ,, ...	1·5	8·5	19·0	... ..	8	7	11
No. 2 ,, ,, ...	,, ,, ...	0·8	13·0	19·0	...	7	16	5
Potato manure	,, ,, .	1·25	14·5	16·0	3·5	8	19	4
Orchard ,, ...	,, ,, .	2·3	13·00	14·5	4·5	10	1	7
Maize and fodder crop manure . .	Gibbs, Bright & Co., 37 Pitt-street . .	3·0	11·0	14·0	1·0	8	15	0
Root crop ... ... ,, ...	,, ,, . .	3·25	7·5	11·0	3·0	8	19	11
Leguminous ... ... ,, ...	,, ,, .	. ....	15·5	18·0	2·4	7	18	0
Special orchard manure	,, ,, ...	2·3	12·0	12·8	7·25	11	9	0
Superphosphate	Paton, Burns, & Co., 75 York-st. . . .	......	17·0	...	......	6	8	11

* Prices to be reduced after April.

The Care of Milking Machines.

O. C. BALLHAUSEN, Dairy Instructor.

WITH the difficulty experienced in securing suitable assistance, and the high wages now paid for farm labour, dairy-farmers are once again considering the possibilities of the milking machine. Some ten or twelve years ago numerous milking machine plants were in use, but farmers were largely disappointed with the results secured, and it was not long before machines were discarded in all directions, and hand milking was once more resorted to. It is safe to say that thousands of pounds worth of machines were thrown out in the Richmond-Tweed district, not through any great fault of the machines, but simply because the quality of the cream produced was inferior to that obtained by hand milking. The particular care required to maintain machines in a proper state of cleanliness was not understood; in fact, salesmen, in order to secure business, often misrepresented the position to farmers. No doubt the keen competition that existed between agents at the time made it of greater importance to effect a sale than to secure a satisfied purchaser, and the question of care and upkeep was treated very lightly. Either by this means or as a result of his lack of knowledge of what really constituted dairy hygiene, the farmer eventually became disappointed and disgusted.

Factory managers were not long in finding out the peculiar faults in cream from uncared for milking machines, and particular attention was paid to cream known to be secured through the agency of machines. No quarter was shown (this was before the day of the universal use of the pasteuriser), and any machine cream showing the slightest traces of contamination was quickly classed second grade. The news that machine cream was supposed to be inferior spread rapidly, and was at times exaggerated. This naturally and rightly recoiled on the milking machine business, and sales slumped tremendously.

With some revival of the use of milking machines it is pleasing to note that efforts are being made by some agents to place fairly before the dairy farmer what must be done to secure success. Much more could be done in this direction, and it should be the policy of all milking machine agencies to employ in the erection of plants men who are capable of imparting instruction in the extreme care and attention to detail necessary for the successful working of machines before leaving farmers to their own resources. The statement of any agent, who is unprepared to admit that machines must have great care bestowed upon them, should be regarded very sceptically by farmers who are considering a purchase. This man probably has his mind more on the sale of the machine than the success of the farmer.

Farmers should at once realise that the milking machine is the most delicate of their dairy utensils, and the one to which the most methodical and regular attention in the way of cleaning must be devoted if the best quality of cream is desired. The separator is comparatively a simple thing to care for, all parts being of metal and easy of access and inspection. The milking machine has numerous small rubber tubes, piping teat cups, inflations, &c., the condition of which is hidden from view without considerable dismantling. Even when taken to pieces the inside of the long rubber tubes cannot well be seen, and no part of the machine is more frequently the cause of inferior cream than the neglected rubber portions. Cream equally as good as hand milked cream can be produced by the aid of machines, but they must be given proper care. Any farmer unprepared to give them the attention required had better not have anything to do with machines, for he is booked for very early disappointment if he does.

Points of a Good Machine and its Operation.

Admitting that, from an economic point of view, a good milking machine plant is a sound investment, and (without going into the merits of the different makes) a farmer would be well advised when about to purchase a plant to have regard for the following features. As the releaser system is the type principally used, all piping, both vacuum and milk piping, should be erected in lengths and with fixtures that will permit of easy and quick dismantling when necessary. This applies also to the vacuum tank. The internal diameter of all piping should be maintained through the unions; this prevents recesses for the accumulation of contaminating matter. As far as possible right through the system there should be a smooth surface without sharp angles in the piping, and without seams. The interior of the metal portion of the teat cups should be machined smooth; in fact no interior portion of the plant anywhere should have a rough or uneven surface. Preferably also the inflations should consist of short sections of rubber tubing, which are easily inspected and cleaned. Moulded inflations, as well as being more costly, are much more difficult to keep clean, and there is a tendency to use these more costly inflations long after they should be discarded.

Having a reliable plant embodying these features, and a knowledge of the reasons for the failure of some of the earlier users of machines, the whole responsibility for the production of good cream now rests with the operator. It has invariably been found that the greatest success is secured where the farmer himself, or some of the older members of the family, supervise the milking business and undertake the care of the machines. Frequently when investigating the source of inferior machine cream the discovery has been made that the cleaning has been left to hired help or some of the junior members of the family. In almost every instance it has been found that the root of the trouble has been the continuous neglect of some portion of the outfit and more particularly of the rubber tubes and inflations.

Causes of Milk Contamination.

One of the most common faults is the use of tubes and inflations after the rubbers have become soft and spongy. Occasionally I have seen inflations in use so sticky and soft that the surface could be rubbed to pieces by hand, and it can be left to the imagination what kind of filth was exuded from the rotten rubber and mixed with the milk with each squeeze of the machine. This applies most frequently to the thick moulded type of inflation. Rubberware in this condition should be burnt, for it is teeming with putrefactive germ life, and its effect on milk and cream requires no explanation.

Without reaching the sticky stage it is a very common fault to find the rubber softened by the action of the fat in the milk. Rubber always softens when in contact with grease or oils, and the better the quality of the rubber the more rapid the softening effect appears to be; the careful motorist knowing this always keeps oil and grease well away from his tyres and tubes.

Rubberware softened in this way is a sure sign of slovenly cleaning, and greater difficulty is experienced in keeping it in a sanitary state due to its naturally porous nature. In fact rubber in this condition cannot be cleaned and it is a much better plan and a good investment to obtain a complete new outfit of rubberware, and from the commencement avoid this softening effect by proper attention. Hot water, with some washing soda added, together with the brush, will always remove the grease and prolong the life of the rubbers, and at the same time the soda will act as a good germicide.

The effect of the softening of the rubber portion of milking machines has been particularly stressed, as from my experience this is one of the most fruitful sources of contamination, and gives to cream that characteristic bitterness so frequently associated with the cream from neglected milking machines. It is not, of course, the rubber substance itself that is wholly responsible for the taint, but the germs which are carried along with the flow of milk and which grow so comfortably in this bed. This putrefactive matter has at times been traced to a depth of over $\frac{1}{8}$ of an inch below the surface in some of the thick rubber inflations. Where these conditions are present, investigation usually reveals the presence also of decaying milky matter in the piping, near milk cocks, in recesses in the unions, or in any of the seams or depressions in the plant over which milk flows—further evidence of an inefficient method of cleaning and often of an inefficient plant.

Cleaner Handling During Operation.

Assuming that the necessary instructions for the mechanical operation of the machines have been given by the erecting engineer, and that the installation of the plant is complete, it will first of all require a thorough washing to remove all grease from the metal parts, and chalky substances from the rubbers, by scrubbing the tubes and inflations with the brushes provided for cleaning these parts, and afterwards the flushing out completely of the assembled plant with scalding water.

Prior to attaching the machines to the cows, the udders and teats should be wiped over with a clean wet cloth to remove any dirt or dust. Sometimes considerable quantities of water are slapped on to the udder and not properly wiped off again. This water gravitates to the point of the teats, carrying with it small particles of dust and dirt, and when the teat cups are placed in position, a drop of dirty water falls immediately into each cup. The udder and teats should always be wiped free from such any surplus moisture to prevent this simple and immediate contamination of the teat cups. Clean water and a clean cloth should always be used for cleaning the udder and teats. During milking, care should be taken that the teat cups do not fall off and so suck in any dust or small particles of dry manure that may be present on the floor of the bails. With the improvement in teat cups, the tendency to fall is not now so common as in the earlier days of the milking machine.

The Regular Cleansing.

The milking and stripping completed, we now come to the regular washing of the machines, and it is this attention that determines the success or failure of their use. One of the most common systems of cleaning recommended by agents is the flushing of the plant after each milking with cold and scalding water for a whole week. It is also sometimes recommended that once during the week the plant should be taken to pieces and all parts brushed through. It is claimed that the attention insures a sweet and clean milking machine plant.

What would be thought of the person who applied such a system to the washing of his separator. What likelihood would there be of his securing a high-class cream with such management? Such advice is absurd and entirely misleading, and is apparently only given to make the care required appear infinitesimal to a prospective buyer.

To ensure clean machines, the maximum life of the whole plant, and a satisfactory product, the system of cleaning outlined in the following remarks should be closely followed. As soon as the last cows have been milked, the machines must be cleaned, and under no circumstances should the milk be allowed to dry in or on the tubes or cups. Each set of teat cups should be cleaned outside in turn, using a pail of lukewarm water, and a scrubbing brush. Follow this, starting at the far end of the bails, by drawing up a couple of gallons of luke warm water for each set of cups by immersing them in the water. The cups should be lifted occasionally allowing air into the cups and tubes; this sets up an agitation of the water inside, and assists materially in removing the milk from the smooth surfaces. Each set of cups having been treated in this way, they should all be gone over again in a similar way using this time a gallon to each of scalding water with a little soda in it.

This will remove the milk fat, and clean the smooth surfaces, but it should be remembered that it will not wholly remove any deposits of contaminating matter in the recesses that may be present in the milk pipes. The brush provided with cord attached should be used for scrubbing the milk pipe line, but the bristles will not reach the corners of any recesses near the unions. If there is any unevenness in the joints in this pipe it must be removed for cleaning. A well set-up pipe with close-fitting joints simplifies cleaning.

Finally, draw up about a gallon of clean scalding water to each set of cups to remove traces of soda water. If the drops are allowed to dry the soda may cause black spots, and eventually a slight roughening of the tinning in the pipe.

The rubber parts and teat cups may now be removed and immersed in a trough containing a solution of brine or limewater, but a formalin solution is better. Lime, whilst having a good sweetening effect on the rubber, very soon turns the metal portions of the teat cups black. Soda produces the same effect. Formalin has no effect on the metal, and is a good germicide. A solution containing from 2 oz. to 3 oz. of formalin to 10 gallons of water is recommended. The cups and tubes should be well covered, and care should be taken that no air is present in the pipes. The formalin bath should be renewed once or twice a week. Never immerse the tubes and inflations in ordinary water, as it has no value, and if not absolutely pure is likely to do harm.

All cocks and valves should be left open to thoroughly air the system. Most plants now have easily demountable vacuum tanks, and these can easily be aired, and washed out when necessary.

A clean-up as outlined above will do for each alternate milking, but in addition, at least once each day, and preferably after the morning's milking, the rubbers, claws, inflations, and small metal pipes must be disconnected, washed, and brushed out with the brushes provided, using a solution of hot water and soda. No matter what may be said to the contrary, without this daily disconnecting of small parts and brushing out, the rubbers, claws, &c., cannot be kept in a sanitary condition. No special treatment is required for other portions of the machine, but they should be given the usual washing applied to other dairy utensils.

Before each milking, the teat cups and pipes should be drained, and after connecting up a rinsing with a little clear scalding water should be given the system. This will remove all traces of the formalin solution, and sweeten up the plant for the immediate milking.

The Power Supply.

If the separating is done in the room containing the engine, vacuum pump, &c., the machinery should be kept very free from surplus oil, and the engine exhaust should be carried well above the outside top of the walls. It is preferable to have the engine and pump in a room distinct from that used for separating. The odours of engine oil and exhaust fumes are very easily absorbed by milk and cream, and they impart very disagreeable tastes to both.

Electric power, where obtainable, is particularly applicable to the driving of dairy machinery. Its smooth operation, reliability, freedom from exhaust gases, and minimum quantities of oil required for lubrication, ensure a total absence of the objectionable taint so frequently met with where oil engines are in use. Unfortunately electric power for farm use is practically unknown in New South Wales, although in New Zealand a start has already been made to provide electricity by the expenditure of £20,000,000 on an extensive scheme for town and country districts. For the present supply of power a demand has set in from the country, particularly the dairying districts, for the running of milking machines, separators, and other farm machinery, as well as for domestic use in farm houses. It is claimed that the demand from the dairying centres will prove the backbone of the country consumption of power, and New Zealand's experience in this regard should be a useful guide when our own extensive hydro-electric schemes are developed in the neighbourhood of our most important dairying districts.

There are farms in many parts of the coastal districts having all the facilities for a small private hydro-electric supply, sufficient to operate the machinery on the average dairy farm, apart from providing lighting and other conveniences in the farmer's home. Electric power, secured by the operation of a water wheel, is the cheapest power obtainable, and also the most reliable.

Hot Water.

Where milking machines are used, the necessity for an ample supply of good hot water at all times for washing-up purposes is more important than ever. Attention has already been drawn to the scanty supply of hot water so frequently used in the washing of dairy utensils, but where milking machines are used there must be no stinting of water. It might be surprising to many to know that some farmers are paying up to £4 and £5 for a waggon load of firewood in the Lismore district. Hot water, with wood at that price, is expensive, but it must be used, and it is in cases of this kind that the domestic bath heater becomes such a money-saving adjunct to the dairy.

The water supply might also often be improved upon by providing more water tanks. Very many dairies become absurdly short of washing water during short dry spells.

In conclusion. it might be as well to say, that after an experience of thirteen or fourteen years of machine-produced cream in different parts of the State, I am of the opinion that the average milking machine cream is not as good as the average hand-milked cream, and that this result has been largely brought about by the lack of instruction to farmers when the machines were installed. If milking machines are used and cared for as they should be, the average cream produced from their milking will be as good as average hand-milked cream.

Swine Fever.

W. L. HINDMARSH, B.V. Sc., M.R.C.V.S., D.V.H., Government Veterinary Surgeon.

OF all the diseases which affect pigs in this country none is capable of causing more loss than swine fever, or hog cholera as it is called in America. The disease is usually so rapidly fatal, and spreads with such alarming rapidity through the herd, that it is rightly feared among pig-farmers as the most dangerous scourge to which their stock are liable.

It is nearly twenty years since the disease was first recognised in New South Wales. As a result of the discovery, quarantine regulations and the slaughter of diseased pigs were enforced in all infected piggeries, and it is owing to this strict control that the disease has been prevented from spreading over the State and causing serious loss. The regulations are still enforced where outbreaks of swine fever are detected, and the movements of pigs within the metropolitan area are rigidly controlled.

The Causal Organism.

Swine fever is caused by a germ which gains entrance to the blood stream, and is thus carried throughout the body. The germ is so small that it cannot be seen with the most powerful microscope, and on this account it is known as an ultra-visible organism. At one time it was considered that another germ, commonly found in the intestine, was responsible for the disease, but further investigations and repeated experiments have proved that this bacillus, although associated with swine fever, was only secondary in its effects and that the actual cause was circulating in the blood. Besides being present in the blood, the virus is found in the discharges from the sick pig, and these discharges as well as the blood can set up the disease in healthy stock. Swine fever attacks pigs only; other domestic stock are not susceptible to it.

Spread of the Disease.

The germ is usually taken into the body through the mouth with the food or water, and though it is also stated that infection can occur from the air breathed in, the former is the more common channel by which the germ enters the body. The eating of food soiled with the blood, dung, and other discharges of infected pigs is the usual method by which swine fever is spread through a piggery, and this may, therefore, occur in any of the following ways:—

1. By actual contact of healthy with diseased pigs.
2. By healthy pigs eating and drinking from the same troughs as diseased pigs.
3. By the eating of portions of the carcase, dung, blood, and discharges of diseased pigs.

4. By the use of buckets, implements, &c., for healthy pigs after they have been used in infected sties.
5. By the carrying of portions of diseased discharges on the boots and clothes from diseased to healthy piggeries.
6. By the virus being carried in the dust from an infected to a healthy herd, although so far as is known at present, the germ is not carried any great distance by the air itself.

After infection has occurred it may be from four days to three weeks before signs of the disease become apparent. The virus will remain alive for a considerable period in an infected piggery, especially if the sties are damp and dark. Sties should be built to allow plenty of fresh air and sunlight to enter, sunlight being a most efficient germicide. It is to be remembered that all discharges, dung, urine, nasal discharge, blood and flesh of infected pigs are capable of setting up the disease, and if these are kept in a damp, sheltered spot, they will remain infective for some months. Similarly, litter about the piggery, and muddy holes where the pigs wallow, are fruitful sources of infection. Young animals are more susceptible to the disease and take it in a more acute form than adult pigs, but the disease is liable to attack swine of all ages.

Symptoms.

It cannot be said that there are any symptoms especially indicative of of swine fever. In the same piggery where a number of pigs are affected entirely different symptoms may appear, although the disease is in all cases due to infection from the same germ.

For practical purposes it is usual to divide the types of the disease which most commonly occur into three main classes, viz. (*a*) very acute type, (*b*) acute type, (*c*) chronic type.

(*a*) *Very Acute Type.*—Pigs affected with this type of swine fever usually die within twenty-four hours of the first onset of symptoms. Sometimes they are noticed to be quite healthy in the morning and are dead the same evening. The pigs may be noticed to have sudden fits of shivering, to be off their food, to stagger in their gait, and to have rapid, difficult respiration. Often they lie down and are unable to rise again. There is great thirst and the temperature rises to the vinicity of 107 deg. Fah. Death occurs a few hours later.

(*b*) *Acute Type.*—In this type, death may occur in four days to two or even three weeks, after the first symptoms are noticed. The pigs will be seen first to be off their feed, to lie about in dark corners, and they are not easily roused. Thirst is marked, and there may be attempts to vomit. The skin is dry and hot, the back arched, the head carried low and the tail limp. In many cases dark red blotches appear on the skin, especially about the ears, belly, flank, and the inside of the legs, these of course being more noticeable in white pigs. Sometimes these reddish blotches become blistered, especially about the ears, where sores commonly form. At first the animal shows signs of constipation but later a profuse diarrhœa may set in. The discharges are grey to blackish in colour, have an offensive odour, and are sometimes streaked with blood. The eyelids become swollen and have a sticky discharge, which often glues them together. A similar sticky discharge runs from the nose. Signs of pneumonia, with rapid, difficult breathing may be present, the pig appearing at times as if about to suffocate. The urine is scanty and dark in colour. Marked weakness of the limbs and staggering gait is usually seen, the weakness daily becoming more marked. Weight is lost rapidly, the flanks become tucked up and the spine and ribs show up markedly. Death may occur within two or three weeks, but in some cases the animals make a partial recovery and the case passes from the acute to the chronic type of swine fever.

(c) *Chronic Type.*—This type may set in from the beginning, or it may occur as a result of a partial recovery from the acute form. Animals so affected may live up to eight weeks after the first symptoms of illness are noted, but have been known to live for some months, being unthrifty, and failing to put on flesh, and yet taking their food fairly well. Such cases are extremely dangerous, as healthy animals may contract the disease from them in a more virulent form. In this type of the disease the pigs are dull, the skin is dry and harsh, and the eyes and nose discharge a sticky material. The appetite is capricious; for some days the animal feeds well and at other times is off its food altogether. Constipation alternates with diarrhœa, the dung in the latter case being dark, fœtid, and often blood-stained. The red blotching of the skin is not so marked as in the acute type, but usually the ears become covered with scabby sores. The animal gradually becomes more and more unthrifty in appearance, losing flesh and becoming emaciated. There may be a chronic cough and breathlessness, especially if the pigs are moved about the yard. Often the hind quarters lose strength, the gait is staggering, and eventually paralysis may set in. In breeding sows, abortion may occur and in sows suckling their young cessation of the milk supply may result. In many cases, apart from a general appearance of unthriftiness, few of the above symptoms may appear, and it is these cases, as already pointed out, that are most dangerous.

General Remarks on Symptons, and Diagnosis.

After reading the foregoing it will be seen that no one definite train of symptoms can be considered as especially indicative of swine fever. The symptoms of pneumonia might in some cases be due to an outbreak of infectious pneumonia, while the diarrhœa and symptoms of digestive derangement may be due to an inflammation of the alimentary tract owing its origin to a purely local cause. The diagnosis therefore depends on the combination of these varying symptoms and the constant and sudden losses of pigs under differing conditions. Where pigs kept under good conditions have been in good health and no change has been made in their feeding and housing, and yet they begin to show signs of illness and die, it is safe to suspect that some contagious disease is present. This is especially the case if the disease appears after new pigs have been introduced or contact direct or indirect has taken place with other pigs. Further evidence will be obtained from the examination of the carcase of a pig dead of the disease.

Post Mortem Appearances.

Owing to the fact that the virus of swine fever is circulating in the blood stream, the changes produced in the tissues are widely distributed through the body, and vary in different cases. Further, the invasion of the body by other germs in conjunction with the virus of swine fever also produces definite changes. Still, the alterations found are to some extent constant.

In the acute type of the disease there may be few changes of importance in the body that will be noticeable to the untrained eye, death being due to septicæmia (blood poisoning) with little apparent alteration in the organs. Usually the body is emaciated, but sometimes the condition is good, this depending upon the length of time the animal has been ill. There may be discoloration of the skin, and signs of diarrhœa, nasal and eye discharge. A straight cut should be made from the anus to the throat, opening the belly but taking care that the bowels are not punctured. The layers of muscle under the skin will often show small hæmorrhages appearing as dark red spots about the size of a pin's head. On pulling the cut walls of the belly apart a considerable amount of straw-coloured or blood-stained fluid may be seen in the cavity. The walls of the stomach and intestines often show blood-stained areas and sometimes the loops of intestine are adherent to one another. The lining membrane of the stomach and intestines may show small hæmorrhages scattered over the surface, or areas of the surface may show a diffuse red colour. Sometimes areas of the inner surface of the stomach may show a yellowish or greyish deposit, adherent to the underlying membrane and raised above the surface of the membrane itself. Commonly too, especially in cases of chronic swine fever, ulcers or areas of necrotic (or dead) tissue are found extending along the inner surface of the bowels. These areas are especially seen at the junction of the small and large intestines; often they form raised, dark-coloured lesions varying in size, but commonly about the diameter of a sixpence. At one time their presence was looked upon as diagnostic of the disease. While their presence is undoubtedly of significance, it has since been shown that these so called "button ulcers" may occur in pigs not infected with swine fever. The contents of the bowels are usually semi-liquid and frothy, while those of the large bowel are often pasty and offensive. Close to the bowel, within the membrane that suspends it, are to be found small bean-shaped and long oval bodies up to 2 inches in length. These are lymphatic glands. Normally dark to light grey in colour, they become enlarged and hæmorrhagic with swine fever, sometimes the whole gland being diffusely red, and at other times only small hæmorrhages being seen. The kidneys become enlarged, may be paler or darker than normal, but are soft to the feel. On the surface may be seen few or many red spots, giving the organ a mottled appearance. The incision might now be carried through the ribs close to their junction with the breast bone, to expose the heart and lungs. The typical changes found in lungs in acute swine fever are allied to those seen elsewhere, in that there may be seen pin-point hæmorrhages scattered as red spots on the normal pink lung surface. Often the lung is dark in colour, is firm and not elastic to the touch. On cutting such a lung the cut surface becomes covered with a bloody frothy material. Parts of the lung may appear quite solid, the colour varying from greyish to reddish, while sometimes there are yellowish cheesy areas where the lung has become broken down and the lung substance in that part is dead. The glands between the lungs are similar in appearance to those along the course of the intestine.

Control of Swine Fever.

Measures for the control and suppression of swine fever are given below, but it must be born in mind that this disease is scheduled under the Stock Disease (Tick) Act, and hence stockowners are under the obligation of reporting the occurrence of the disease to the local Stock Inspector at once. This officer will then take the necessary precautions and advise the owner as to the necessary procedure.

1. *Isolation of Introduced Pigs.*—All newly introduced pigs should be isolated for one month before they are allowed to have contact with other pigs on the farm. The cost of an extra sty and yard in which newly introduced stock could be placed for observation would be very small in comparison with the loss it might save should those pigs be carrying the disease. This isolation pen should be at some distance from tho other pig yards. Where possible the history of the stock proposed to be purchased should be obtained so that the risk of acquiring diseased stock will be lessened.

2. *Prevention of Contact with Diseased Piggeries.*—Prevent, as far as possible, contact direct or indirect with piggeries where deaths have been known to occur. When breeding or show stock have been sent to other piggeries or shows and have thus been in contact with pigs from other parts, they should be isolated on their return to the home farm. Store pigs purchased at auction sales are a fruitful source of infection of many diseases, and such stock also should be isolated before being placed with the pigs already on the farm. Where there is any suspicion that swine fever exists in your district, allow no person, animal, nor implement which has had contact with the diseased piggery to go near your stock ; the disease is easily carried and the infection may be transferred in this way. Similarly a stream running through an infected piggery may transmit the disease to other pigs lower down its course.

3. *Isolation ofall Sick Pigs.*—Isolate all sick pigs whether swine fever is suspected or not. There are other contagious diseases of pigs, and when an animal is ill no risk should be taken.

4. *Destruction of Carcases and Discharges.*—All pigs dead of swine fever should be burned where they lie, and the blood and discharges gathered with a shovel (taking half an inch of the underlying earth with them), and placed on the fire. Quicklime should be plentifully scattered about the ground when the discharges are thus gathered up.

5. *Destruction of Contacts.*—Pigs that have been in contact with the diseased stock should be killed. If healthy, the carcases will be passed for human consumption by the inspector. Should the pigs be retained, although apparently healthy it will be found that within a few days they will begin to sicken and die

6. *Treatment of Sties and Yards.*—Where swine fever has once occurred in a piggery, the diseased animals destroyed, and the healthy slaughtered, it is advisable when re-stocking to rebuild the piggery on a new site, and not to use any of the material from the old piggery in the construction of the new sties. In many cases this would be no hardship to the pig raiser, since so many sties are of poor construction, insanitary, and unsuited for the housing of pigs. Where the old sties are of bush and old timber they should be burned where they stand and the yards ploughed up or limed. However, when the sties and pens are of modern construction they should be subjected to a thorough cleansing and disinfection. All refuse and litter must be raked up and burned. The troughs and guttering and floors should be flushed and washed with boiling water and sprinkled with chloride of lime. The walls must be scrubbed with soap and water containing 5 per cent. disinfectant, and limewashed, the limewash also containing disinfectant. The posts and rails of the fences should be similarly treated. The yards should be ploughed or dug and plentifully scattered with freshly slaked lime.

No healthy pigs should be introduced into these pens for at least three months, and before their introduction another complete limewashing should be carried out. All utensils, brooms, buckets, rakes, shovels, &c., should be washed with strong disinfectant, while the clothing and boots of the attendants should be disinfected when they have completed the treatment of the house and yards.

7. *Improvement of the Hygiene of the Piggery.*—More attention generally should be paid to the hygiene of the piggery by the pig farmer. Attention to the cleanliness of the house and yards, the correct construction of the sties, and more sanitary methods of feeding would result in better health among the stock and make the raising of pigs a more profitable business to the owner.

THE COMMERCIAL VALUE OF TOMATO SEED.

THE value of the tomato seed rejected by sauce and pulp-makers has lately attracted some attention in the United States. Tomato seeds contain approximately 22 per cent. of a valuable oil, and the cake that remains after the oil is expelled contains about 37 per cent of protein. According to the *Weekly News Letter* (U.S.A. Department), experiments conducted in the chemical laboratory of the Department of Agriculture have shown the waste seed matter to have a high food value. Young albino rats were fed on a diet in which tomato seed cake was the only source of protein, the diet being made adequate in other respects by the use of other foods. On this diet the rats grew at a normal rate, showing that the proteins of the tomato seed contain all the amino acids that are essential to the growth of animals. It was also found that the press cake (seed cake after the oil had been expressed) contained sufficient of water-soluble or antiberi-beri vitamine.

Some Notes on the Packing of Long Types of Apples.

W. J. ALLEN and W. W. COOKE.

Most packers of fruit have at times experienced a certain amount of trouble in packing the longer types of apples, *e.g.*, Adam's Pearmain, Buncombe, Cleopatra, and Delicious. This is not only due to their length approaching or exceeding their transverse diameter (it is only in abnormally long specimens that the latter occurs), but to the irregularity of their length, specimens of the same diameter varying considerably. If packed on the "flat," this irregularity of length renders it more difficult to secure such evenness in the depth of tiers as to present an even surface on the face of the packed case, with the necessary spring or bulge. But it is preferable to pack on the "edge," especially when packing the longer types of fruit; not only is this style better for the packer, but an edge-pack presents the fruit to the buyer with the most attractive appearance, especially if what is known as a "closed" pack is adopted. A closed pack, however, cannot always be used, especially in the Canadian case (20 x 11⅛ x 10 inches), owing to certain sizes "coming up" too high. Most of the Canadian bulletins show diagrams of an open pack, *i.e.*, arranged with the "eye" or calyx ends of the fruit all pointing one way—usually from the packer (see Fig. 1). Even when packed on edge this open pack does not "open up" as well as the closed pack, which is detrimental, as a good appearance helps to sell the fruit; there are also other objections. Having occasion to pack a fair number of long-type apples in the Canadian case, and wishing to keep to an edge-pack throughout (as specially requested by the firm to whom the fruit was to be consigned) the idea presented itself that the inequality in length referred to might be absorbed—might be made use of to advantage, in fact—by placing the fruit in diagonal rows with the calyx or eyes all pointing one way, *i.e.*, along the diagonal. Thus, with fruit of even size (the diameter of each specimen would be about equal, though the length would vary), no difficulty would be experienced in keeping each tier an even height, and giving the case the correct spring or bulge. The accompanying illustrations show the placing of the fruit for the various packs 2-1 to 3-3. The packs 2-1 and 2-2 would be used mostly for the Australian bushel case (18 x 14¼ x 8¾ inches), while the 3-2 and 3-3 are especially suitable for the Canadian case, though this would be decided by the size of the fruit to be packed. It should be clearly understood that the bulk of the packing done on this system at Glen Innes Experiment Farm has been in the Canadian case, using the 3-2 and 3-3 packs; further testing will, therefore, be necessary with the Australian case, the 2-1 and 2-2 packs having been included more to show the placement used with these packs. From experience gained with the half-bushel Australian case, however, the method should be of use in packing the bushel case, and probably could be extended to include oranges. It is not intended that this style of packing should replace the well-tested "closed" diagonal packs, which, indeed, it could not do, being totally unsuited for packing flat types of apples, but to be used in conjunction with it, and thus with the 3-2 four-tier and 3-3 five-tier packs to secure, if possible, an edge pack throughout in the Canadian case, and thus remove one of the chief objections to the use of that case.

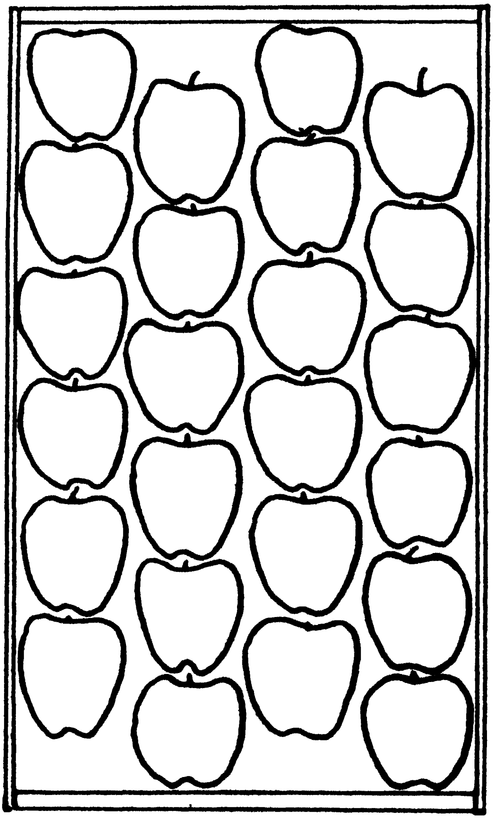


Fig. 1.

Commencing with the 2-1 pack, Fig. 2 (*a*) shows how the pack is commenced. It is not absolutely necessary to follow the exact order of placement explained later, but this arrangement of the fruit is suggested as being the one which experience has shown to be the simplest and most effective. No. 1 apple is placed in the left-hand corner of the case, with the calyx pointing into the corner; No. 2 is placed with the calyx pointing into the right-hand corner; No. 3 may be placed with either the stalk or calyx end against No. 2, but No. 4 should be placed with the stalk end against No. 3, the calyx consequently pointing to the side of the case. Fig. 2 (*b*) shows the placing of the next three apples. No. 5 has the calyx pointing to the side of the case, No. 6 has either the stalk or calyx against the stalk end of No. 5, while No. 7 has the calyx end pointing to the left-hand side of the case. Fig. 2 (*c*) shows the first tier completed.

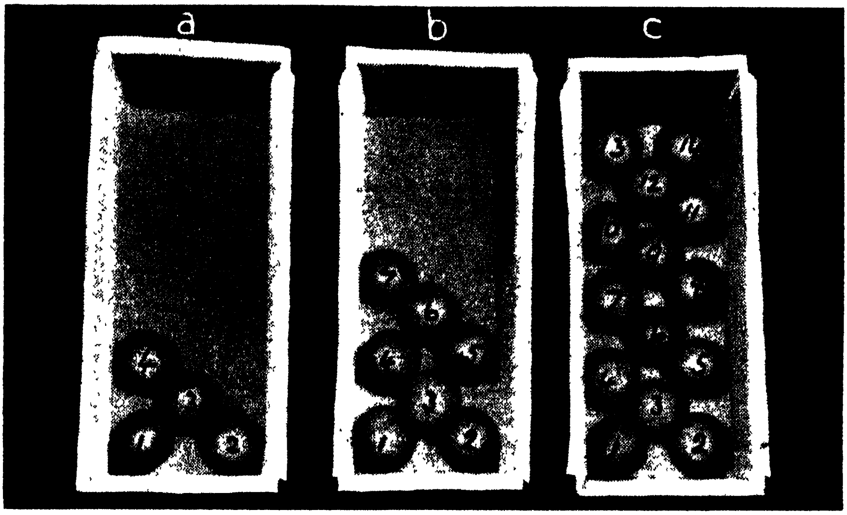


Fig. 2.

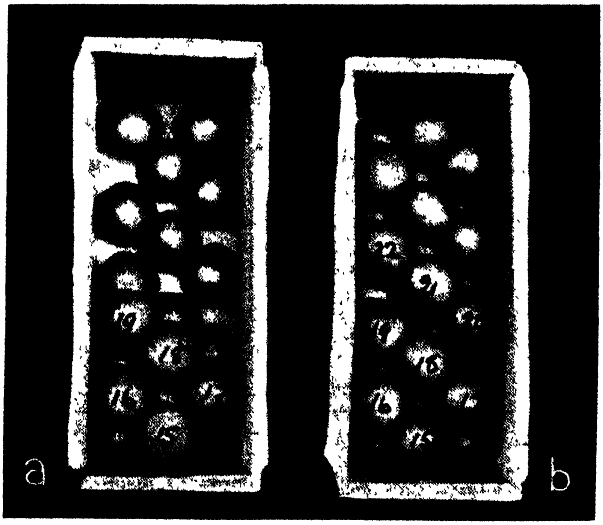


Fig. 3.

It will be noted that the calyx end of the fruit always points to the side of the case by this arrangement, which gives the most attractive appearance to the case if it is opened on the side, while the more tapering formation of the calyx end allows the fruit to fit closer to the side of the case than the stalk end would.

Fig. 3 (*a*) shows the commencement of the second tier. No. 15 (the first apple of this tier) is placed in the space formed by Nos. 1, 2, and 3, with the calyx to the end of the case nearest the packer, and the stalk pointing to the left-hand side of the case. No. 16 has the calyx end to the side of the case. The packing now proceeds diagonally in the row of spaces formed by the fruit in the lower tier. It is this packing

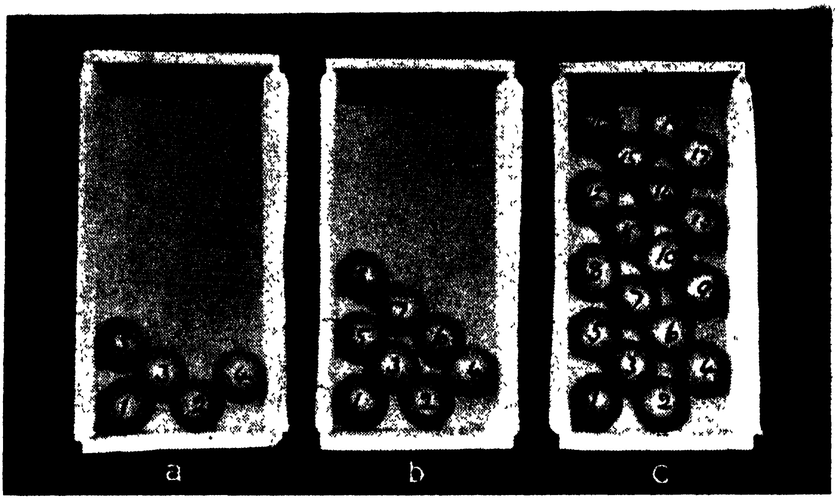


Fig. 4.

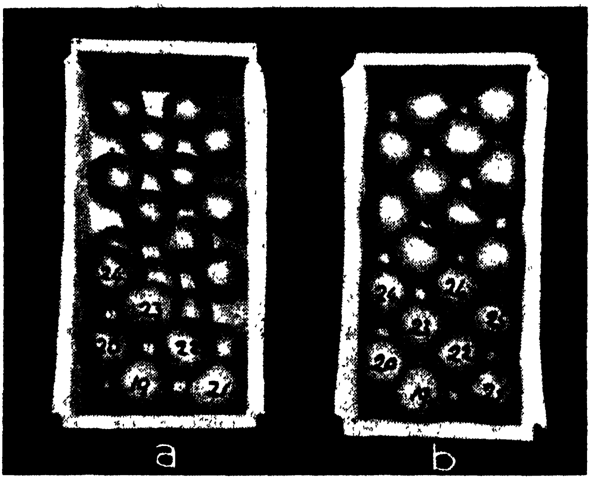


Fig. 5.

diagonally with the calyx and stalk ends pointing along the diagonal that allows of the inequality in length of the long-typed apples to be absorbed, a long and a short specimen together equalling two of normal length—all having the same diameter—while careful selection enables each diagonal to be packed sufficiently tightly, for should it require a slightly longer specimen to complete the diagonal this may be chosen, the diameter (which governs the size) still remaining the same.

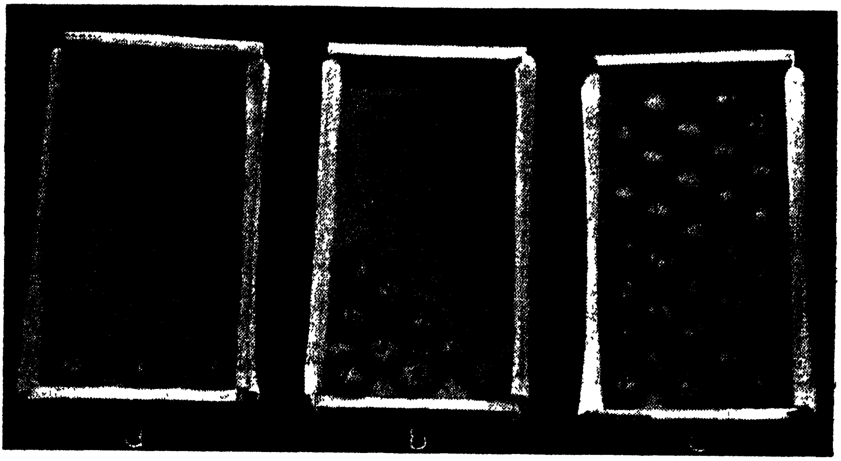


Fig. 6.

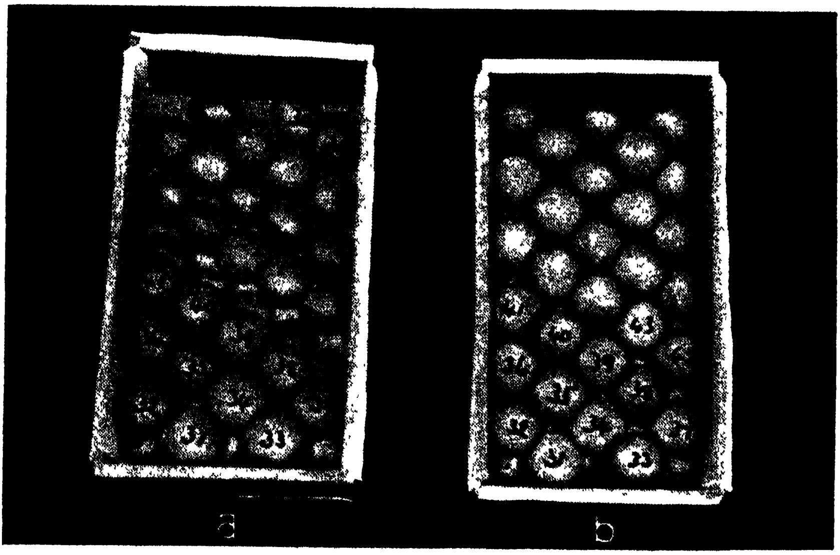


Fig. 7.

The commencement of the 2-2 pack is shown in Fig. 4 (*a*). It will be noticed that No. 4 is placed in position before the diagonal formed by

Nos. 2, 3, and 5 is completed. This is to prevent No. 2 being forced out of position, which would probably occur if No. 5 were placed in position before No. 4. No. 2 is placed about half-way between the side of the case and No. 1, with the calyx end to the corner of the case. Nos. 4 and 5 have the calyx end pointing to the respective sides of the case. Fig. 4 (*b* and *c*) shows the continuation and completion of the first tier, while Fig. 5 (*a* and *b*) shows the commencement and completion of the second tier.

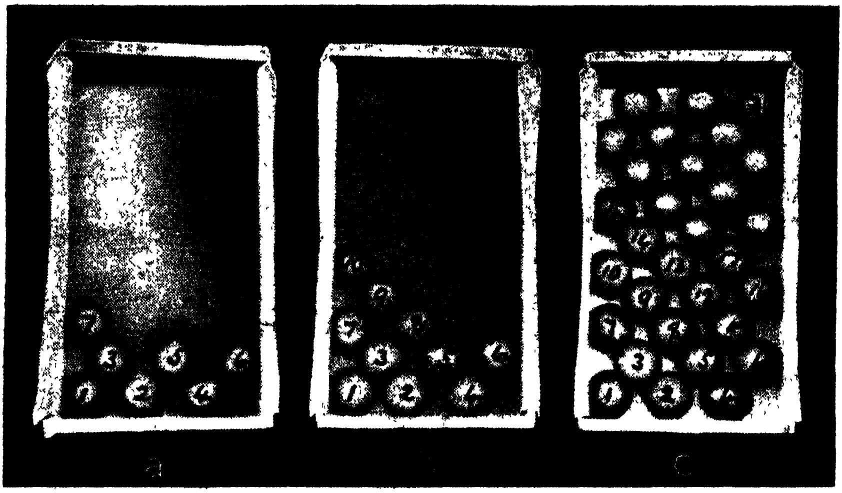


Fig. 8.

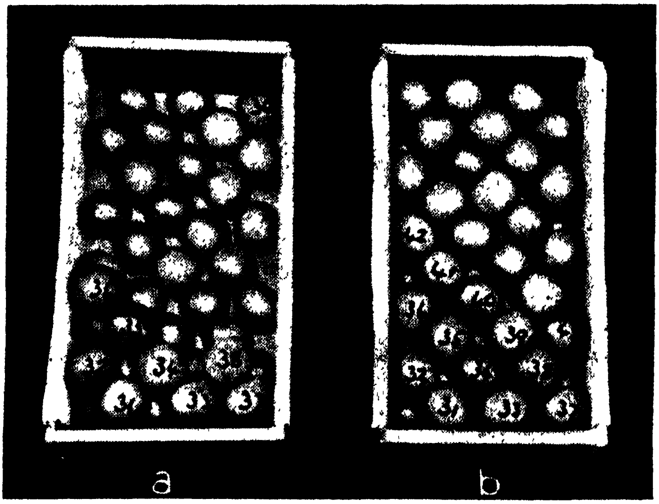


Fig. 9.

Fig. 6 (*a*, *b*, and *c*) shows the start and finish of the first tier of the 3-2 pack, the numbers showing clearly the placing, remembering that, with the exception of No. 1, the stalk and calyx of the apples point along the diagonal from the right-hand side of the case to the left-hand side. Fig. 7 (*a* and *b*) shows the start and completion of the second tier of this pack.

The placing of the apples in the first tier of the 3-3 pack is shown in Fig. 8. The arrangement of the first seven apples (see *a*) may appear complicated, but in practice it is not, and although a different start might be adopted—such as placing Nos. 1, 2, and 4 first in the case—yet the placement shown in Fig. 8 (*a*) is that which has proved the most effective in retaining the fruit in the desired position.

No. 1 is placed with the calyx in the corner of the case, No. 2 with the calyx to the end of the case next to the packer; No. 3 may have either the stalk or calyx to the stalk end of No. 2; No. 4 has the calyx to the end of the case; No. 5 may have either the stalk or calyx to No. 4; No. 6 has the calyx to the side of the case, as has also No. 7. Fig. 8 (*b* and *c*) shows the continuation of the first tier.

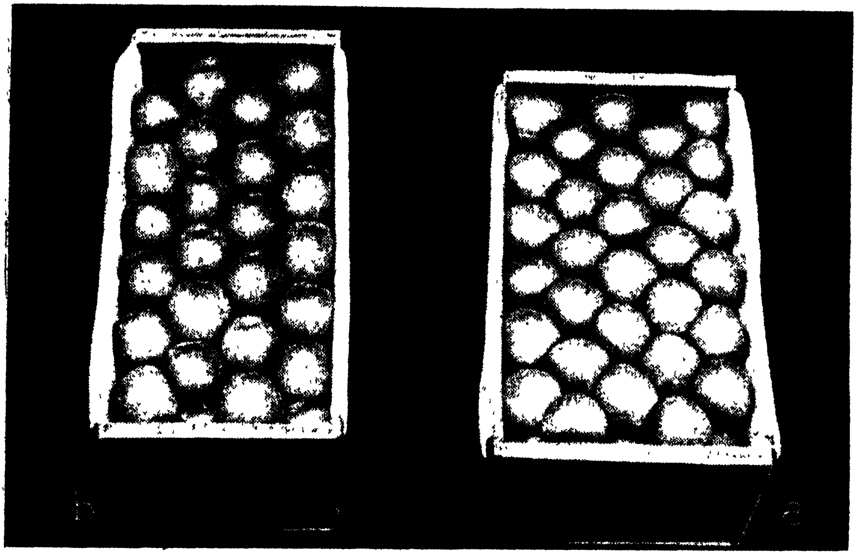


Fig. 10.

The commencement and completion of the second tier is shown in Fig. 9.

The fact that the packing is done diagonally tends to speed in packing, as several apples can be taken up at the same time, using both hands and placing along the diagonal, provided the fruit has been sized or that the packer is a sufficiently expert sizer. This advantage is more noticeable when using the Canadian case, where the increased width (11¼ compared with the 8¾ inches in the Australian bushel case) allows of greater freedom in using both hands to pack.

Fig. 10 shows a case fully packed: (*a*) is a four-tier pack (3-2, 6-6 = 120 apples), opened at the top, whilst (*b*) shows the same pack opened at the side.

Control of "Collar Rot" of Citrus Trees.

SOME ORCHARD EXPERIMENTS.

C. O. HAMBLIN, B.Sc., B.Sc.Agr., Assistant Biologist.

THE disease known as "collar-rot," which affects citrus trees, manifests itself most frequently by gumming on the trunk just above or close to the ground. In many cases if the area of gumming is examined, the bark in the vicinity will be found dry and brittle. Trees may be attacked at all ages. When a young tree is attacked there may be chlorosis or yellowing of the leaves, especially on the terminal twigs, but with older trees the yellowing may not appear until the tree has been nearly ringbarked at the trunk. The decay proceeds upwards to the stem and downwards to the roots. A fungus (*Fusarium*) is constantly found in association with the disease. It makes its first inroads through an injury or through water-logged bark. Sometimes tiny white tufts can be observed in the diseased bark. The tissues of the trunk are slowly affected, and if the disease is unchecked the ringbarking of the tree may be brought about. Sometimes a tree will set a fairly heavy crop before death.

The "union" of a tree is often a point of entry, and should therefore be kept well above ground. Care should be taken to avoid injury to the bark of trees, especially with shovels and hoes when removing weeds. It is also to be remembered that the condition is favoured and developed by bad drainage, while damp conditions in the soil in immediate contact with the trunk are also undesirable. The practice of mulching close up to the trunks of trees should be avoided. Red oil injury to the bark may favour the ingress of the disease.

As various treatments have been recommended for the excision and dressing of "collar rot" areas on the trunks of trees, an experiment was planned to test the efficacy of two mixtures—bluestone paint and bluestone paste. These experiments were conducted at Matcham, near Gosford, the details of the work being carried out by Mr. O. Brooks (Orchard Inspector) and the writer, in the orchard of Mr. I. Anderson, now the property of Mr. G. Falkiner. Both the latter gentlemen have rendered the Department valuable assistance.

On 22nd December, 1920, six lemon trees definitely affected with "collar rot" were treated by cutting out all diseased wood around the areas of gumming tissue, and then pasting the diseased areas over with bluestone paste. The paste was made by taking 1½ lb. of bluestone (copper sulphate), 4 lb. quicklime, and 1⅓ gallons of water. The bluestone was dissolved in portion of the water, and the lime was slaked with the remainder. When the lime had lost its heat and been thoroughly stirred into a stiff paste, the dissolved bluestone solution was mixed with it. The result was a turquoise-blue paste.

On the same date six other lemon trees affected with "collar rot" were treated in a similar manner by cutting out all diseased bark and wood. The trees were then painted over with bluestone paint. This paint was made by using 1½ lb. copper sulphate, 1 lb. lime, 2 gallons water, and was prepared as described above. The result was a thin fluid which could be applied with a brush.

These trees were kept under observation until February, 1921, when it was noticed that although there were signs of recovery, and the callus had begun to form on the edge of the injuries, a certain amount of gumming was appearing at the edges of some of the cuts and occasionally in the depth of the wounds. It was clear that this was due to the fact that small amounts of diseased tissue had not been removed at the time of excision. It was therefore decided to treat the trees again. On 4th March the trees were therefore carefully examined, and the following observations made :—

(*a*) Trees treated with bluestone paint and bluestone paste looked equally well.

(*b*) In nearly all cases it was clear that the treatment had arrested the progress of the disease. Two trees which had been practically ringbarked by the disease before treatment showed themselves unable to recover and were setting a heavy crop of small fruit, becoming more chlorotic in the foliage and obviously about to die.

(*c*) Gumming occurred in some trees on the surface of the old wound where the rot had been deep, and was not fully excised in the first case. In other cases gumming was observed in the margin of the diseased area, and it would appear that a certain amount of the mycelium of the causal fungi had withstood the cutting, and not been brought into contact with the fungicide owing to the protective action of healthy and dead tissue between it and the fungicide. The beads of gum were very small in most cases.

(*d*) Where circumstances had made it possible to cut the bark in a very clean fashion back to healthy tissue, callusing was proceeding rapidly and well.

The trees were now treated a second time, cutting out any further gummed patches as thoroughly and as neatly as possible. For this purpose a curved wood chisel was found useful, and also a knife rounded at the point.

The wounds were painted with bluestone paste and bluestone paint, as in the previous treatment. When inspected on 22nd April, 1921, all the trees treated appeared to be making good recovery, and the wounds were healing over. In one or two cases very small gum spots were noticed and again painted over. Diseased trees (untreated) in the same orchard still retained the characteristics of the disease.

On 29th July, 1921, the trees were inspected. All but one of the treated trees had ceased gumming, and appeared to be completely cured of the disease. In only one case in the experiment was any gumming noticed. This was on the margin of a cut, and obviously a small amount of infected tissue had been left; the removal of about a square inch of bark and a redressing remedied this. All the trees were carrying crop, including even the badly ringed ones. These two trees had not been removed, and were putting forth a certain amount of new growth. It would be possible to save them, but, doubtless, they would not be of great value from the grower's point of view. The success of the treatment where trees had not been affected in such a way as seriously to reduce the area of bark available for conduction was marked, and undoubtedly a complete cure was effected in these cases. The trees are still (March, 1922) bearing well and look healthy.

A Diseased Tree.
Unhealthy bark removed and bluestone paste applied.

The relative merits of these two successful compounds—bluestone paint and bluestone paste—may be summarised as follows :—

Bluestone Paint.	*Bluestone Paste:*
Can be easily applied with a brush.	Must be applied with a knife or spatula.
Can be spread over the stem and healthy parts with rapidity.	Rather more difficult to apply.
Provides a thin layer.	Provides a thicker fungicidal layer.
Lasts well.	May last longer than paint.
Dry.	Tendency to hold water, if too thick, may be a detriment. It is difficult to say whether this is an advantage or detriment as regards its fungicidal action.
Gives very thin layer.	Useful to plug rough cavities.
Fungicidal action good.	Fungicidal action good.

It is evident from this experiment that if the disease is detected early, precautions taken to excise carefully the diseased bark in the region of gumming, and the paste or paint then applied, trees can be cured. It is, however, necessary to watch for any reappearance of gumming and to treat it promptly.

Pure Seed.

GROWERS RECOMMENDED BY THE DEPARTMENT.

THE Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Wheat :—

Bomen	Manager, Wagga Experiment Farm, Bomen.
	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
	H. M. Hall and Sons, Studbrook, Cunningar.
Canberra	W. W. Watson, Woodbine, Tichborne.
	H. M. Hall and Sons, Studbrook, Cunningar.
Cleveland	W. Burns, Goongirwarrie, Carcoar.
College Purple	Manager, Experiment Farm, Temora.
	Hughston Bros., Marsden-street, Boorowa.
Currawa	Manager, Experiment Farm, Temora.
	Hughston Bros., Marsden-street, Boorowa.
	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
Federation	Manager, Experiment Farm, Trangie.
	Harvey Bros., Enterprise, Dubbo.
	H. M. Hall and Sons, Studbrook, Cunningar.
Firbank	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Trangie.
	Harvey Bros., Enterprise, Dubbo.
Florence	Manager, Experiment Farm, Trangie.
	Manager, Experiment Farm, Coonamble.
	Manager, Experiment Farm, Glen Innes.
Gresley	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
	Manager, Experiment Farm, Cowra.
	Gollasch Bros., Milbrulong.
Hard Federation	Manager, Experiment Farm, Trangie.
	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
	H. M. Hall and Sons, Studbrook, Cunningar.
Improved Steinwedel	Manager, Experiment Farm, Trangie.
	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
Major	Manager, Experiment Farm, Temora.
	W. W. Watson, Woodbine, Tichborne.
	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
Marquis	Manager, Experiment Farm, Glen Innes.
Marshall's No. 3	Manager, Experiment Farm, Temora.
	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
Penny	Manager, Experiment Farm, Temora.
	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
	W. W. Watson, Woodbine, Tichborne.
	E. J. Allen, Gregra
	H. M. Hall and Sons, Studbrook, Cunningar.
Sunset	Manager, Experiment Farm, Coonamble.
	Manager, Experiment Farm, Nyngan.
Waratah	Manager, Experiment Farm, Cowra.
Warden	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
	Gollasch Bros., Milbrulong.
	B. J. Stocks, Linden Hills, Cunningar.
	H. M. Hall and Sons, Studbrook, Cunningar.
Warren	Manager, Experiment Farm, Trangie.
Yandilla King	Manager, Wagga Experiment Farm, Bomen.
	B. J. Stocks, Linden Hills, Cunningar.
	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
Zealand	Manager, Experiment Farm, Temora.

PURE SEED—*continued.*

Oats :—	
Algerian	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Glen Innes.
Guyra	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Glen Innes.
	Manager, Experiment Farm, Bathurst.
Lachlan	Manager, Experiment Farm, Bathurst.
Ruakura	Manager, Experiment Farm, Glen Innes.
	Manager, Experiment Farm, Bathurst.
Sunrise	N. S. Meek, Hobby's Yard.
Barley :—	
Kinver	Manager, Experiment Farm, Temora.
Cape	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Coonamble.
Trabut	Manager, Experiment Farm, Cowra.
Rye :—	
Black Winter	Manager, Experiment Farm, Bathurst.
Clovers :—	
Shearman's Clover (roots)	J. H. Shearman, Fullerton Cove, Stockton.

In addition to those tabulated a number of crops were inspected and passed, but as the growers failed to forward samples their seed has not been listed.

FIELD TRIALS THE BEST GUIDE TO FERTILISER REQUIREMENTS.

WHEN cultivation has been properly done, sufficient farmyard manure or a proper substitute applied, and adequate care exercised in the selection of suitable varieties of crops, then the farmer can hope to derive the greatest possible benefit from artificial manures.

It is, however, necessary for him to know three things—(*a*) the proper mixture to use; (*b*) the proper amount to apply per acre; and (*c*) the best time for application. Nothing short of direct field experiments gives the necessary information, and it is by no means easy to discover the proper mixture. Years ago it was thought that the problem could be solved merely by ascertaining the ash constituents of the plants and making up a manure corresponding thereto: it is now known that no such short cut is possible. A competent chemist could prepare no fewer than 6,000 different brands of potato fertiliser, each useful under certain conditions. Field trials alone enable one to decide which of all these is the best in any given case.—E. J. RUSSELL, Director, Rothamsted Experimental Station.

THE VALUE OF STANDARDISATION.

PROBABLY in no part of the world is standardisation in relation to farm produce a more live thing than in California. Yet the history of standardisation in that State goes back only some seven years, the first law on the subject being passed in 1915. Said a speaker at the last annual convention of fruit-growers and farmers held recently at Los Angeles: "Anyone who witnessed the miscellaneous mass of horticultural products thrown on the market ten or even five years ago can realise why fruit-growing did not pay. Standardisation is the life-blood of the fruit and vegetable industry in California, and in the face of increasing yields and high cost of transportation it will pay bigger that ever before."

Poultry Notes.

APRIL.

JAMES HADLINGTON, Poultry Expert.

OBSERVATIONS made during the month go to show that many hens that have finished their second laying season are still on the farms. Except in the case of specially good specimens that are being retained for breeding purposes on account of their quality, or laying performances or both, these should be disposed of as soon as possible after they have ceased to lay. This matter was dealt with more fully in a recent issue, but in view of the loss likely to be sustained in keeping these old hens after their profitable age is passed, a reminder is not out of place. Carrying such hens through the winter spells loss to the farmer.

Make Up the Breeding Pens.

This is the month in which we should have all breeding pens made up, or at any rate the hens in the pens, so that they will settle down before the cold weather sets in. It is a good practice to have all pens made up by 1st May, remembering always the aim should be to have eggs ready for the incubators by 1st June. Therefore April is not too early to commence to select, cull, and recull the breeding stock. In practice it works out that even after one has made what is considered a good selection there will still be some to be rejected and replaced by others. In respect of this factor alone, time is a valuable aid to efficient work in selection.

What to Select.

On a well managed farm there will be a choice of at least two and probably three ages of birds from which to select breeders, viz., pullets, and one- and two-year birds—that is to say, rising one, two, and three years. There will not be many of the latter at this time of the year, because the only justification for having kept them will be that they are exceptional birds in some way, as most of the rising three-year mediocre birds will have been disposed of. As a general rule the advisability of breeding from birds rising three years is open to question, and can only be justified on the score of quality, either from a breed or laying point of view, or from necessity. The choice will, therefore, for the most part fall upon birds rising one or two years or both. Other things being equal, perhaps mating one year with two would be the most desirable, but here again other factors come into the calculation. If, for instance, the pullets or cockerels (*i.e.*, birds under twelve months old), are not well grown, or are immature, it will be best to fall back upon the older birds. But if there are suitable pullets and cockerels available, there is no reason why they should not be used as breeders, either mated together, or the younger birds mated to the older, preferably the pullets to the older male birds.

Pullets and Cockerels.

In this connection one often encounters opposition to the idea of mating young birds on both sides. The soundness of such matings depend upon the age and development of the birds. I have many times pointed out that to mate immature or undersized birds is to court failure in regard to the progeny and subsequent influence on future breeding operations, but in this, as in everything else, one must be guided by experience, and there is abundance of proof of the soundness of such matings if proper selections have been made, that is to say, in respect to age, development, &c. Birds should be well developed, and at least ten months old when eggs are required from them for setting. The progeny of such matings have been justified by results over many years of the writer's experience. Not that one would advocate such matings exclusively for reasons already alluded to There is, however, always one important consideration in favour of the younger birds ; that is the earlier laying of the pullets and the activity of the younger male birds as compared with the average old bird during the winter months when it is desired to secure eggs for early hatching. The farmer who relies solely upon two and three year-old birds generally succeeds in getting too large a proportion of late hatched chickens, for the simple reason that he has failed to secure sufficient early and fertile eggs.

Matings.

Discussing this matter very naturally raises the question of relationships that it is advisable to mate as against outcrossing. It is not the purpose of this article to discuss line breeding or breeding by chart, further than to warn the person making the matings that too close breeding is playing with fire in so far as stamina and constitution are concerned. It is not the work of the novice, who might be unable to select birds in the light of a thorough knowledge of the breed character, or without information as to how closely the birds have been bred. In such cases outcrossings, *i.e.*, mating two different strains of the same breed, is the safest plan, or at any rate the safest starting point.

Essentials to Breeding Quality.

It is not given to every farmer to be a first-class breeder of stock of any kind. It is only the person who possesses the requisite knowledge of the breeds as set out in the standards, and of the principles of breeding generally, plus a certain amount of natural ability or intuition, who is uniformly successful in producing birds of high quality.

Breeding simply by chart might be mathematical in its incidence, but unfortunately nature, if it does conform to mathematics in some ways, is intolerant of them in a general way. Breeding by chart or according to stated relationships without proper selections must fail.

Again, with regard to outcrossings, the factor of affinity of type and character must be taken into account. The nearer the approach to affinity of type that can be secured in birds to be mated, the more the success likely to attend the work of the breeder. If, for instance, improvement in some particular is required, let the would-be breeder take time over securing the desired improvement, whether it be size or some other feature. This is best achieved by selections over a series of years, rather than by an attempt to reach the objective in one year, remembering always that any rude clashing of types will lead to reversion. This, of course, refers to what may be designated as sub-types within the breed, and also to large and small birds.

Introducing New Stock.

From what has been said above, it will be apparent that there are vital considerations in connection with the introduction of new stock. It goes without saying that the best are not too good to breed from, and, further, that no bird is perfect. Hence the necessity for good and continuous selections. Nor does it follow that because a bird has a good pedigree that it is sure to prove good stuff to breed from. As a matter of fact, pedigree counts for little if the bird belies the reputation attached to it. Hence the absolute necessity of every breeder being in some measure a judge of the breed he runs.

It is feared that we have reached a stage in commercial poultry farming where more attention is necessary to the bird than to its pedigree. Many farmers are paying dearly for the shadow without securing the substance. We have reached a stage in commercial poultry culture when the farmer will pay prices for his birds equal to the average prices that at an earlier period were paid for exhibition stock. There is nothing wrong with this, except that he does not always get value for the money paid, principally due to his trust in pedigrees and want of knowledge of the birds themselves. If the evil effects were confined to the first-hand transaction, they would have but little significance for the industry. Unfortunately, this is not so, and the pedigree business is passed on and on without regard to the quality of the stock itself, and with disastrous results to the industry as a whole. The remedy is to trust not in pedigree alone, but in the quality of what it purports to represent.

CAUSE OF SECOND GROWTH IN POTATOES.

THE effects of continued drought on potatoes are generally most evident in the maturing of the tubers; these remain small and ripen prematurely, those that attain an approximately normal size being apt to show uncommonly large formations of secondary tubers. The explanation of this latter phenomenon is that after prolonged foliage development, the underground eyes of the potato plant develop tubers which store the already manufactured starch. The drier the summer the more quickly the tuber ripens. The cells (except the youngest about the eyes) gradually lose the ability to increase in size to any extent. If now, after drought, rain falls, the young cells around the eye, with their still elastic walls, begin to grow, and a secondary tuber, superimposed on the primary one, results.—G. P. DARNELL-SMITH.

Orchard Notes.

APRIL.

W. J. ALLEN and S. A. HOGG.

Preparing Land for Planting.

INTENDING planters should this month prepare their land and maintain it in a suitable condition for the planting season. It is advisable that the land should be ploughed and left in a rough state, so that the soil may become sweetened and at the same time the winter rains be absorbed and retained. It may then be worked to a fine tilth and kept free from weeds until the trees or vines are set in position. If the ploughing was not started last month it should be immediately attended to, especially in dry districts, where the retention of the limited rainfall during the winter months is so essential. In districts that enjoy a bounteous rainfall, and especially where the orchards were planted on an excessive slope, it may be an advantage to allow the weeds to grow for the next three months. The same remarks apply where water is available for irrigating, as if there was a shortage of rain during the winter water could be applied to soften the land and enable ploughing to be carried out. In districts where the rainfall is neither excessive nor light, a medium course may be adopted by ploughing every second row during this month, and leaving the unploughed portion to grow weeds, with a view to holding the soil and preventing it from washing. Considerable difficulty is met with by the orchardist who has his trees planted on a hillside, as he is prevented from giving them thorough cultivation and enjoying the benefits well recognised in other parts as attaching to such treatment. In fact, it is questionable whether country that cannot be thoroughly cultivated is suitable under ordinary conditions for the production of fruit.

Planting Refills.

Where a tree has died and the surrounding trees are still vigorous, it is sometimes very hard to account for the premature death of the one. It is quite possible that if every case could be thoroughly investigated, trouble of a bacterial nature might be found responsible. As a provision against the continuation of the infestation, it is recommended that upon the removal of the dead tree the hole be excavated to within reasonable dimensions, and the tree cut up and burnt in the hole. In fact, it is a good plan to create a fire of some considerable magnitude so that any injurious germs that may be in the soil may be killed; further, while the fire is burning, the earth that has been removed from the hole should be sprinkled upon the burning embers until the whole of it has been thoroughly sterilised.

Grading and Packing of Apples and Pears.

Growers are warned against the careless handling of fruit during the period of picking, packing, and carting. The picking of apples and pears really requires intense care, as the smallest blemish, caused even by long finger-nails on the hands of the operator, frequently becomes the seat of disease which may spread throughout the case. Again, having picked the fruit with care, the boxes should be handled so that there will be as little jarring and bumping as possible. The fruit should be graded, and blemished and under-sized fruit should not on any account be mixed up in the grades. The grower does not even yet quite realise the difference that a well-packed case makes to his banking account. From inquiries lately made on the market, it was ascertained that a well-packed box will realise from 2s. to 3s., and sometimes, in the case of citrus fruits, as much as 6s. per case, in advance of the prices realised for poorly-graded and imperfectly-packed cases.

A case that has been well packed should arrive at the market in a firm condition; hence it is necessary to pack (apples particularly) with a slight bulge, so that on nailing down the lids a spring will be created by the bottom and top boards and such tension lent to the whole as to keep them all in place. On no account should the case be nailed down on a cement floor, or, indeed, on a floor of any kind, unless the ends are separated by two slats, thus giving the bottom of the case an opportunity to spring without bruising its contents.

It is preferable to wrap practically every grade of apples over 2¼ inches. There are many advantages in wrapping. In the first place the case can be packed tighter, the wrapping paper acting as a buffer between the layers of apples; while if any individual specimen develops disease which was not noticeable at the time of packing it is not so likely to contaminate the rest of the fruit as if unwrapped.

Scale Insects on Citrus Trees.

Where trees are seriously affected by the above-mentioned pests, and the trees are vigorous, fumigation may be carried out this month, but, as pointed out in previous notes, the best results are obtained when the fumigation is carried out in January or February. Although fumigation will kill scale at any time providing the work be properly done, the dead scale remain adhering to the fruit for a considerable time, so that fumigation should be carried out at least three or four months before the fruit is to be marketed. It will generally be found that by that time the dead scale will have fallen off.

Manuring.

It has been found from experience that citrus trees, even when growing on rich volcanic soil, are greatly benefited by re-soiling and manuring, particularly if they have carried heavy crops for several years. Experience shows that either re-soiling or manuring are beneficial, but a combination of the two is a decided advantage. In re-soiling citrus trees, surface soil from an adjoining piece of land should be removed and placed immediately around the tree, but care should be taken not to waste the earth by putting it right underneath the branches and up to the butt of the trees; it should be deposited to a depth of 6 or 8 inches in a ring round the trees, starting from the outside of the branches, and extending out for 3, 4, or 5 feet, as the case may be. It will be found of great benefit if, before applying the soil, manure in the form of blood and bone be mixed with the earth so as to become thoroughly incorporated before it is applied round the trees.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1922.

Society.	Secretary.	Date.
Royal Agricultural Society of N.S.W.	**H. M. Somer**	**April 10 to 19**
East Dorrigo A. Association	**T. B. Timms**	,, 15, 17
Auburn Agricultural Bureau	J. J. Pratt	,, 22
Orange A. and P. Association	**G. L. Williams**	May 2, 3, 4
Narrabri P. A. and H. Association	E. J. Kimmerley	,, 3, 4
Upper Manning A. and H. Association (Wingham)	**D. Stewart**	,, 3, 4
Clarence P. and A. Society (Grafton)	**L. C. Lawson**	,, 3, 4, 5, 6
Hawkesbury District A. Association (Windsor)	**H. S. Johnston**	,, 4, 5, 6
Wellington P. A. and H. Society	**A. E. Rotton**	,, 9, 10
Lower Clarence A. Society (Maclean)	E. D. Munro	,, 10, 11
Dungog A. and H. Association	**W. H. Green**	,, 10, 11, 12
Dubbo P. A. and H. Association	F. Weston	,, 17, 18
Coonamble P. and A. Association	J. C. Wilson	,, 23, 24
Warren P. and A. Association	**A. C. Tompon**	June 7, 8
Murrumbidgee P. and A. Association (Wagga)	**A. F. D. White**	**Aug. 22, 23, 24**
Corowa P. A. and H. Society	**J. D. Fraser**	,, 29, 30
Gunnedah P. A. and H. Association	**M. C. Tweedie**	,, 29, 30, 31
Junee P. A. and I. Association	**T. C. Humphreys**	**Sept. 5, 6**
Northern A. Association	**J. T. McMahon**	,, 7, 8, 9
Cootamundra A. P. H. and I. Association	**Wm. A. Sowter**	,, 12, 13
Holbrook P. A. and H. Society	**Jas. S. Stewart**	,, 19, 20
Temora P. A. H. and I. Association	**A. D. Ness**	,, 19, 20, 21
Murrumburrah P. A. and I. Association	**W. Worner**	,, 26, 27
Narrandera P. and A. Association	**W. H. Canton**	,, 27, 28
Ganmain A. and P. Association	A. R. Lhuede	,, 12, 13

A Cheap Cow to Keep.

A simple calculation shows that the more milk a cow gives the cheaper becomes the cost of food per gallon, because a four-gallon cow does not require twice as much fodder or roots as a two-gallon cow—a double allowance of cakes and meals will usually suffice. The most economical herds are those that yield well on a normal ration. This is a matter mainly of breeding and selection, and one of the main objects of a milk-recording society is to show the members which of their cows produce the most milk, so that these cows may be used as foundation cows, put to a bull of good milking strain, and the heifer calves reared.—G. H. Garrad, in the *Journal of the Ministry of Agriculture* (London).

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Agricultural Gazette of New South Wales.

The Production and Breeding of Wheat.*

A. H. E. McDONALD, Chief Inspector of Agriculture.

WHEAT-GROWERS are keenly interested not only in how better yields may be obtained, but also in future market prospects. If greater quantities of wheat are to be produced, a reasonable assurance is required that good markets will be available for the grain.

While it is difficult to make accurate forecasts owing to the generally unsettled state of world affairs, as a result of the war and of weather vagaries in producing countries, there is sufficient justification for an expectation of good prices continuing to rule for some time. The market is now dominated by North American crops. In 1921, Canada and the United States had a surplus for export of 400,000,000 bushels; but recent reports indicate that only poor crops will be harvested this year in some of the largest wheat-growing localities in the United States, so that the next harvest, which will be gathered about August, will give a much smaller surplus than last year. Importing countries take about 610,000,000 bushels of wheat, while the amount which can be supplied by exporting countries is about 650,000,000 bushels, of which Australia supplies about 100,000,000 bushels. Allowing for a normal carry-over, it can be seen that the average production is practically only equal to consumption, and that any untoward event would produce a shortage, and therefore a marked rise in prices.

The cost of production is a very important factor in determining the amount of wheat produced in each country. It is particularly important in the United States, where farming is very diversified and where, therefore, the farmer has much freedom in his choice of crops. During the past few years we have had evidence in Australia of the effect of this factor. During the war costs of production increased, and as sheep-raising provided an attractive alternative, wheat-growing decreased in popularity, and in this State a reduction of nearly 2,000,000 acres was recorded in 1919, as compared with 1916.

It is a common belief that wheat is grown on large farms in the United States. As a matter of fact, the total area of the farm there averages only about 150 acres, and of this only about 50 or 60 acres are under wheat each year. As the areas are small the cost of production is correspondingly high, but as the farmers have a wide choice of crops the area sown to wheat is reduced and more attention is given to others if the price falls below the cost of production.

The Australian farmer, on the other hand, is particularly favoured in regard to cost of production and has thus a decided advantage over his

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*** Paper read at the conference of western branches of the Agricultural Bureau held at Parkes on 27th and 28th April, 1922.**

competitors. The land is easily cultivated, and consequently the farmer can sow large areas, while harvesting is facilitated by machinery capable of rapidly taking off the grain. While good prices may be expected in the immediate future, it is nevertheless in the interests of wheat-growers to farm thoroughly, so that the highest yields may be obtained. At present many are working on a very narrow margin, and a fall of a few pence per bushel may lead to a loss on the year's operations.

Many farmers look to improved varieties as a means of ensuring that good crops will be harvested, but while good varieties must be selected, the use of these cannot compensate for poor cultivation, late seeding, or other unsound methods. Success can only be achieved by close attention to all the details of preparation, seeding, and harvesting.

The paramount necessity in successful wheat-growing in all districts with a rainfall of less than about 15 inches during the growing period is thorough fallowing. The importance of this has long been recognised by leading wheat-growers in the Riverina, in Victoria, and in South Australia. In the two last-named States fallowing is the basis of farming, and has made wheat-growing profitable in the mallee country with a rainfall of 10 to 12 inches per annum. Probably the most favoured wheat-growing district in New South Wales is that around Wagga, and yet farmers there find fallowing profitable. Practically all the wheat in that district is sown on fallowed land.

The loss of a crop (even a very poor crop) is disastrous to a farmer, and yet, where fallowing is not practised, a crop may be lost in any year. There is no business man in any other line who would dare take the risk of losing a year's outlay.

Fallowing removes such risks by—

1. Insuring that the crop can be sown at the correct time ;
2. Conserving moisture in the soil to augment any rain that may fall during the time the crop is growing ;
3. Destroying weeds such as wild oats, &c. ;
4. Destroying the spores of diseases such as take-all ;
5. Increasing the amount of available plant-food ;
6. Sweetening the soil, and generally putting it into a condition that will promote vigorous growth.

While fallowing is practised in the western district, its value is not yet sufficiently recognised, although during the past year or so the system has been more widely adopted. Mr. Watson, of Tichbourne, has carefully fallowed for many years, and has made available to us his yields, which afford most convincing evidence of the value of fallowing. During the past eighteen years he has averaged 18 bushels per acre from his fallowed land, while the unfallowed land has given an average of 11¾ bushels. Of greater importance still are his figures for 1914 and 1919—two drought years. In 1914, the fallowed land gave a fair yield of 8½ bushels per acre, while the stubble land gave a yield of only 2 bushels—little more than seed. In 1919, the fallowed land gave an average yield of 10 bushels, while the yield from the stubble land was only 3 bushels.

Fallowing is particularly valuable in ensuring that the seed can be sown at the right time. Last year, it will be remembered, after harvest the land became very hard, and consequently it was impossible to get much of the seed into the ground until late in June and July. Dry weather prevailed during the spring and early summer, and the late-sown crops practically failed, while, on the other hand, the early-sown crops gave satisfactory yields. Unfortunately, similar conditions in regard to the season are again occurring, and it appears that it will be late this year before wheat can be sown on land that has not been fallowed

It is important that varieties suitable to the locality and the soil should be chosen. A general recommendation can be made of Yandilla King Marshall's No 3, Federation, Bomen and Warren for early and mid-season sowing, and of Canberra, Clarendon, Hard Federation, Gresley and Improved Steinwedel for mid-season and late sowing. As soil conditions vary on different farms, a selection from these must be made. Canberra, for instance, is liable to lodge, and therefore should not be sown on heavy rich soil, while Federation, being rust-liable, should not be grown on low-lying rich land.

Good, sound, well-graded seed should be used. Sprung and bleached or shrivelled grain should be discarded. The very best grain grown on the farm should be reserved for seed. During harvest there is always a risk of rainstorms reducing the quality of the grain, and therefore the very first opportunity should be taken to harvest whatever wheat is required for seed. Amongst other advantages of good, sound, hard grain is that it is not damaged to the same extent during treatment for bunt as soft sprung grain, and it will remain viable for a longer period when sown in dry ground.

Strong plump seed gives a healthier and more vigorous plant than small grain Grading makes the cracked grain available for feed, which otherwise is wasted. The amount of seed depends upon the variety, the time of sowing, and the soil. A fairly liberal quantity should, however, be used. Roughly this would be from 50 to 60 lb. per acre. The risk of bunt renders it necessary to treat the seed carefully. The bluestone treatment still remains the most satisfactory for this purpose, and carefully used it does not damage the seed. Loss only occurs when the treatment is carried out carelessly. Bunty seed should not be sown.

Whether fertilisers are used depends entirely upon local conditions. The use of superphosphate can, however, be commended as a general rule. Heavy dressings are not required—in most cases from 45 to 56 lb. are sufficient. Superphosphate promotes a vigorous root development and thus encourages the growth of vigorous plants capable of resisting drought.

One of the most important improvements which can be made in the cropping system in the western district is the adoption of a rotation. No fixed recommendation can be made in regard to this at the present stage, but the Department of Agriculture is making a number of experiments which will demonstrate the value of various rotations. At the present time wheat is grown so frequently upon the land that its fertility is becoming depleted, while it is also becoming infested with weeds and diseases. The adoption of a rotation of wheat followed by oats, or barley for sheep feed, and then fallow, will lead to higher yields of grain and to a more certain income, because of the fact that returns from wool and lambs will be part of the receipts.

Plant Breeding.

Many farmers are now taking a keen interest in the improvement of wheat, and some have had very encouraging successes Mr. Plowman, for instance, of the Parkes district, has raised a variety which is very promising. A successful breeder of wheat must be gifted with great patience and must be equipped with a thorough knowledge in regard to varieties He must, in the first place, visualise in his mind an ideal in regard to the variety he proposes to create, and he must steadfastly adhere to this throughout. He must also secure, as a starting-point, varieties possessing the characters which conform most nearly to those of his ideal. Thus, if he proposes to create a rust-resistant wheat, a variety having rust-resisting powers must be selected. It is practically impossible to achieve success in this by using varieties which are susceptible to rust. Farrer, in his work, recognised this principle. Thus, in seeking to improve the milling qualities of wheat, he introduced into his crosses the excellent Manitoba wheats, and followed the same principle in securing rust and drought-resistance.

Plants may be improved by selection, or by cross-breeding followed by selection. Improvement by selection is of two kinds - mass selection and line selection Before the principles of plant-breeding became generally known, improvement was secured principally by mass selection. It simply consisted of making a selection of a number of the best plants, the seed from which was sown and increased as rapidly as possible to provide seed for the field crops. By such a method only a very slight modification, if any, could be made in each generation, and improvement was made at an exceedingly slow rate. The origination of a new variety by this method would depend, first, upon its chance presence amongst the large number of plants in the first selection, and second, upon the elimination of all other kinds during the succeeding years of selection.

A marked advance in plant-breeding was made when the principle of line selection was established. It is not so many years since this practice was first adopted, and it is somewhat surprising that it was so long delayed in view of the fact that selection of the individual animal has been a basic principle throughout in the history of animal breeding. Line selection simply means the selection of individual plants at the outset, and the sowing of the seed of each individual separately. Close examination of a field of wheat will show an immense number of variations. Many of the variations are due to environment—a plant may be growing in a specially favoured situation and is therefore stronger and more vigorous than the surrounding plants. Such a variation is not permanent and will not be reproduced in the progeny. In this, and in respect to all other points in regard to breeding, accurate determination can only be made by sowing the seed and watching the progeny.

Although many of the variations are due to environment and are only temporary, plants of permanent variation may be found and may give rise to new varieties of practical value. Success in making such selections will depend upon the skill and knowledge of the operator. Knowledge is absolutely essential, as much time may be lost through selecting and reproducing for a number of years a variety already known and fixed, and which is merely occurring as a stranger in the variety from which the selection is made. As wheat is as a rule self-fertilised, a plant may be selected which is pure and at once gives rise to a fixed pure variety. Steinwedel and Dart's Imperial apparently originated in this way.

In other cases the selected plant may have originated from a natural cross. In this case the seed, when sown, will produce a number of plants with varying characteristics, and the fixation of the variety will have to proceed by selection and will take a number of years.

The origination of varieties by line selection is purely a matter of chance, and although it is possible that good varieties may be secured by this means —and therefore every farmer should be watchful for plants likely to give rise to new sorts of practical value—the plant-breeder must adopt other means to secure quick and satisfactory results. Chance must be discarded, and he must, by crossing, secure by combination the desired characteristics.

The act of crossing itself is comparatively simple. The plant-breeder must, however, possess a very extensive knowledge of varieties grown in his own and in other countries. He must also be in a position to secure these varieties. Farrer in his work drew largely upon Indian, Manitoban, Italian, and other varieties. These varieties in themselves were not suited to our conditions, and indeed in some cases could only be got with difficulty to ripen grain, but they possessed special qualities which, combined with those of our own wheats, enabled new varieties of considerable value to be produced.

The greatest measure of success will be achieved by striving for one quality at a time. Thus, if it is desired to combine high milling quality with yield, a high-yielding wheat should be selected for crossing with a wheat of high milling excellence. After the initial cross is made, the resulting seed should be sown and the progeny carefully noted. The plants will show considerable variation owing to the different combinations of characters brought about by the crossing. Some of the characters will be permanently fixed, but in no one plant will all the characters be permanently fixed at this stage. Variations will continue and occur during succeeding generations, and a process of selection must be rigorously followed with the object of securing a variety possessing characteristics conforming to the ideal of the breeder.

On lines thus briefly indicated, it is possible for a farmer to effect appreciable improvement in the strains of wheat he is growing, and the cultivation of the habit of observation will be found to make production a more engaging and charming occupation than ever. Who knows, too, whether in such a simple and apparently unlikely manner may be uncovered a new variety or a variation that will confer substantial and permanent profit on the industry as a whole?

POISONING FROM MILDEWED FODDER.

SUCH alarming, and, at first sight, mysterious, outbreaks of sporadic disease in horses are sometimes traceable to mildewed, mouldy forage, that farmers, selectors, and stockowners may find the following notes on the subject of interest:—

Hay made during showery weather and imperfectly dried before stacking is very liable to mildew; in consequence, when it is cut into bales, white, mouldy streaks, layers, or patches, are found to have developed in it. Mildew is very noticeable on green lucerne hay, also on ensilage. In damp, humid seasons, forage littered around feeding places, hay stacks, silo pits, &c., undergoing decay, generate heat, and this is accompanied by the development of minute parasitical fungi. Mildew by no means confines its attack to lucerne; all kinds of forage—hay, straw, chaff, clover, trefoil, sorghum, maize-stalk leaves, &c.—are liable to attack, and it must never be forgotten that mouldy food is pernicious to stock.

The early stage of poisoning from mildewed fodder resembles influenza, the symptoms being general debility, failing appetite, staring coat, tight skin, and constipation. The eyes are dull and the sight becomes affected. The animal becomes very sensitive to light, is reluctant to leave or enter the stable, trips when crossing the door sill, and bumps the door posts. The nose is protuded and the throat swollen. There is a frequent low cough and general muscular stiffness, the head and spine are carried rigidly, the feet are spread apart, and the animal walks reluctantly and with difficulty At this stage the symptoms somewhat resemble those of tetanus.

In the second stage of the disease the animal stands with head thrust into a corner, and is obviously very ill; the respiration is hurried and the breath has a sickening, fœtid stench. The air passages are dangerously involved, the throat trouble extends to the bronchial tubes and lungs, and acute broncho-pneumonia supervenes. Respiration becomes very painful and difficult, with a frequent low cough; there is expectoration of tenacious mucus, and a most offensive, purulent, blood-stained discharge from the nostrils. Finally septicæmia sets in, and brings the animal's sufferings to a close.

Post mortem examination discovers the blood to be very dark and liquid, and the spleen much engorged and black. The air passages are greenish-purple, with hæmorrhagic patches, and choked with blood-stained, putrid mucus: the lungs solidified, gorged with black blood, and gangrenous.

The disease is insidious. It may progress slowly, and if the animals take only a small quantity of the noxious feed for a few days, they may on change of diet slowly recover from the illness. Its after-effects may be recognised by the short chronic cough, with the double expiration, known as "broken wind."

Treatment consists of the administration of such medicines as aperients and diffusable stimulants, followed by tonics and inhalations of steam. Mashed foods, gruel, and fresh appetising green feed, with plenty of water should be given.

Stock—horses, cows, pigs, or sheep—will pick at and inhale the spores of mildewed or rusty fodder, left as bedding or scattered near hay stacks. The first procedure, therefore, should be to stop the supply of the contaminated food, clean up every bit of mouldy fodder about the place, and burn it. Securely enclose any tainted (*i.e.* mildewed) food where no stock can reach it.—EDWARD STANLEY, F.R.C.V.S.

The F.A.Q. Wheat.

FOUR YEARS' SAMPLES COMPARED.

G. W. NORRIS, Milling Investigator.

A SAMPLE of the fair average quality wheat available from the current season's crop was subjected to certain trials in the laboratory, and the results may be of interest. The sample was part of the mixture used by the Grain Trade Section of the Sydney Chamber of Commerce when fixing the standard weight for the convenience of the shippers and merchants. The sample was milled, graded, and compared with similar samples of the three previous years, to see if there was any variation in quality.

COMPARATIVE Milling Results.

		1918-19.	1919-20.	1920-21.	1921-22.
Appearance of grain.		Light amber, plump, soft, large, opaque.	Light amber, plump, soft, large, opaque.	Light and dark amber, soft, fairly plump, somewhat bleached.	Mottled, light to dark amber, opaque, medium size, soft, slightly bunty.
Weight per bushel.		62½ lb.	61 lb.	59½ lb.	61 lb.
Ease of Milling ...		Easy to mill	Easy to mill	Easy to mill	Easy to mill
Percentage of mill products.	Flour	71·0	72·7	70·0	71·7
	Pollard... ..	12·0	16·4	16·3	14·7
	Bran	17·0	10·9	13·7	13·6
Colour		Excellent	Excellent	Good	Very good.
Strength		44·6	45·0	43·4	43·8
Percentage of dry gluten		10·1	11·2	10·2	10·3
Character of wet gluten		Yellow colour, elastic, coherent, soft.	Pale yellow, elastic, coherent, soft	Pale yellow, elastic, coherent, soft	Pale yellow, elastic, coherent, soft.

From the above table it will be seen that there is very little variation in the last two seasons, except that the flour is somewhat weaker when compared with the two previous years. The colour also shows signs of weakness. These two facts, although only slight, are to be regretted, and yet what one would expect when quality is being sacrificed for yield, as must be the case under the present marketing system.

CHEMICAL Analysis.

	1918-19.	1919-20.	1920-21.	1921-22.
	Per cent.	Per cent.	Per cent.	Per cent.
Moisture	10·0	10·80	10·58	11·50
Albuminoids ...	11·81	11·56	12·25	11·37
Ether Extract ..	2·24	2·02	1·70	2·20
Ash	1·42	1·38	1·43	1·58
Fibre	1·79	2·17	2·00	1·70
Carbohydrates .	72·74	72·07	72·04	71·65
	100·00	100·00	100·00	100·00
Albuminoid Ratio ..	1 to 6·5	1 to 6·6	1 to 6·1	1 to 6·7
Nutritive Value ..	89·6	88·13	88·09	87·92

TABLE showing grades obtained from a bushel of New South Wales F.A.Q. wheat.

Grade.	1918-19.		1919-20.		1920-21		1921-22.	
	lb.	oz.	lb	oz.	lb.	oz.	lb.	oz.
3·00 millimeter grade ..	...	6¼	...	11¼	2	5¾	9	8
2·75 ,, ,, ..	13	1½	18	6	10	4¾	27	0¾
2·50 ,, ,, ..	33	15¾	21	15½	23	2¾	12	12¾
2·25 ,, ,, ...	7	13	12	0	15	5	6	8
2·00 ,, ,, ..	2	8½	5	4	5	6¼	1	8¼
Broken and grain less than 2·00 millimeter.	4	4¾	2	4	2	12¾	3	0¾
Oats, barley, chaff, &c.	0	6¼	0	7¼	0	2¾	0	9½
Bushel weight .	62	8	61	0	59	8	61	0

Upon examining the different grades, the 1921-22 harvest shows some remarkable changes. For example, if we compare the 3·00 millimeter grade for the past four years, it will be seen that the amount of grain in this grade in the last harvest shows a decided increase. There is also an increased amount of broken and pinched grain, as well as what might be classed as rubbish. This increase of rubbish, and of broken and pinched grain in the last harvest, is worthy of investigation, as it represents a serious loss to the community when we consider that every time a bushel of wheat is handled there is a little over 3¼ lb. of unmillable stock. After deducting the broken grain, less than 2·00 millimeters, there will still be ½ lb. of rubbish in every bushel.

Now, according to the official estimate, there is available for export for oversea from New South Wales 29,000,000 bushels for 1922 harvest, containing 6,473 tons or 241,666 bushels of rubbish.

When this is viewed from a monetary point of view, it will be seen that there is an unfortunate loss of money. If a value of, say, 5/- a bushel be assigned (less what is paid for it), it will represent over £60,000. When the grading of wheat is an established fact, this waste will to a large extent cease to exist after the grain has arrived at an elevator equipped with cleaning machinery.

In support of the advisability of improving the quality of our export sample, the following from the English millers' journal *Milling*, 11th June, 1921, may be quoted. A number of samples (consisting of Bobs, Cedar, Comeback, and Florence) arrived in excellent condition at the offices of *Milling*, and the journal writes:—"It is probable that, if a mixture of these varieties was included in greater proportion in the parcel usually exported to this country, the elusive strength element would be present in addition to the excellent colour and yield qualities, which are already inherent characteristics of Australian wheats. As may be expected from exhibition samples, the usual impurities of Australian wheats, chaff, oats, and weeviled grain, are missing."

WINTER SCHOOLS FOR FARMERS, 1922.

ARRANGEMENTS have been made for the annual Winter School for farmers to be held at Hawkesbury Agricultural College from 27th June to 22nd July next. The syllabus covers a comprehensive course of lectures and demonstrations on agriculture, horticulture, live stock, &c., and in addition, practical training is available in useful work connected with farm life, such as saddlery, engineering, blacksmithing, carpentery, &c.

To meet a popular demand, a special school will be held for those who desire to specialise in the subject of poultry-farming. All branches of the industry will be fully dealt with, and moreover, the students will be given an opportunity of studying such subjects in the general course as are likely to be of value to them.

Farmers and youths over 16 years of age who have been engaged in rural work for at least one year will be eligible for admission to the general course, and admission to the poultry course will be granted to persons of both sexes over the age named who are engaged in poultry-farming.

Applications for both schools will close on 31st May, 1922.

The fee for either course, inclusive of board and lodging, will be £5 5s. Prospectus and full information may be obtained on application to the Under Secretary and Director, Department of Agriculture, Sydney.

THE PROGRESS OF COUNTY-AGENT WORK IN THE STATES.

THE great increase in the expediture on county-agent work in the United States is indicated by the following little table from the United States Department Circular 179, which shows the amounts contributed by the various forms of government in the years 1915, 1917 and 1921, and the totals:—

Source.	1915.	1917.	1921.
	Dollars.	Dollars.	Dollars.
Federal	320,059	538,074	1,491,502
State	165,068	375,111	941,434
County	482,345	732,339	3,148,930
Total	967,472	1,627,524	5,581,666

A National Scheme for Conservation of Fodder.*

W. E. TAYLER, Adavale, Parkes.

LAST spring the following by Mr. A. A. Dunnicliff appeared in the *Daily Telegraph* :—

> In the Coolah valley this season thousands of tons of lucerne that might have been turned into hay or silage have gone to waste. Much of it even has been burnt to get rid of it. It is impossible to regard with indifference such deplorable wastage of fodder that might have been put by for the time, that will assuredly come, when it would have a profit, showing value for stock-feeding and stock-saving. The blame of this lost opportunity to provide for the lean years ahead is not to be charged up against the farmer as evidence of improvidence or callous waste. He is a victim of circumstances.

There is little doubt that the waste of valuable fodder last spring was not confined to the Coolah district alone, but took place in many parts of the State at that time, and will continue to occur in generous seasons until some comprehensive national scheme is evolved and adopted, whereby there will be a market always ready to absorb all suitable fodders for stock at prices payable to the growers.

Local delegates will remember that in May, 1919, I read a paper before the members of the Coradgery branch of the Agricultural Bureau on "artificial feeding of stock in drought time," in which I advocated a scheme whereby all classes of fodder suitable for feeding sheep, such as pressed lucerne, oaten and wheaten hay, oats, maize, &c., should be bought from farmers in times of plenty, and stored in depôts in various centres of the State, to be sold to stockowners in times of drought at cost price, plus interest, cost of storage, handling, insurance, &c. In the paper referred to, I said, and repeat now, "farmers can and will grow all the fodder required for their stock if they are assured of a payable price as soon as it is grown ;" but they are not financially strong enough to grow produce for which there is no immediate market (except at prices below the cost of production), and to store same for an indefinite time, even though they well recognise that, were it possible to do so, they would eventually reap a handsome reward.

When in June, 1921, the Government organised a conference of representative practical men to draw up a scheme, one was submitted by the conference very much on the lines above indicated, and I was indeed hopeful that at last the country had recognised the necessity of some sort of drought insurance; but apparently the matter has been shelved, and, one might suppose from the fact that we never hear the subject mentioned by public men, it is entirely forgotten.

It looks now as if another drought will be allowed to devastate our flocks before we again wake up sufficiently to put such a scheme into action.

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* **Paper read at the conference of western branches of the Agricultural Bureau held at Parkes on 27th and 28th April, 1922.**

I have no desire to criticise the suggested scheme of the above-mentioned conference, any more than to emphasize the point that it should be a national, or at any rate a semi-national, undertaking.

Stockowners are directly concerned when drought losses occur, but indirectly the whole State suffers from the serious effects caused by a shortage in the export of wool and meat. Therefore the general taxpayer should find at least half the money required to finance the scheme.

Further, I might tentatively suggest that the board of control should embrace, as one of its functions, the encouragement of individual effort in the more settled districts, by advocating that on properties where mixed farming is and can be carried on owners should conserve fodder for their own use in times of drought, and assist financially by advancing amounts equal to somewhere near the cost of production on properly secured stack or pressed hay, grain in mice-proof silos, and ensilage.

I quite recognise that advancing money on security of this kind is a somewhat risky undertaking, and to do so in the ordinary way would necessitate an army of inspectors to see that the security was adequately protected, but if the advances were made per the medium of rural credit societies the risk would be reduced to a minimum and no inspector would be required.

It seems obvious that the only practicable way in which farmers can obtain financial accommodation on any perishable security of this kind (where the value is only retained by the initiative and integrity of the owner) is by the establishment of rural credit societies throughout the farming districts. The sooner we get busy in this direction the better. We will be following on the lines adopted by Canada, and other successful agricultural countries of the world.

The scheme submitted to the Government referred to is the result of the careful deliberations of some of our most capable and experienced men, and appeals to me as being most comprehensive and practicable. I can only urge that its immediate adoption is of vital importance to the State, and that all of us who are sufficiently familiar with land and weather conditions in New South Wales to recognise the inestimable value of such a proposal should leave no stone unturned to get the undertaking launched.

If this scheme was a working proposition, let us see how it would advantageously affect the farmer who grows the fodder. The lucerne grower, once he knows that there is a standing minimum price exceeding the cost of production, and that the Fodder Conservation Board is always ready to buy, is immediately in a position to grow as much as his land will yield, without fear of over-production and a non-payable price, or having to burn it, as in the case of the Coolah growers cited above.

Oats, also an excellent feed for sheep, offer wider possibilities. Farmers in the general run of our wheat area recognise that at present there is no payable crop to rotate with wheat, and as the country becomes more closely settled and intensely farmed, it is most essential there should be. Oats can be grown on practically all wheat lands and make a most useful rotation crop; but there being a limited market for it, and farmers who do venture to grow it in large quantities have frequently to sell it at 2s. to 2s. 6d. per bushel—a price far below cost of production. And, perhaps before next harvest comes round, they see it selling at 4s. to 5s. per bushel.

With a payable price guaranteed, farmers would be able to relieve their wheat-sick paddocks wherever necessary, by growing a crop of oats, without risk of incurring a heavy financial loss.

Knowing as we all do the meteorological peculiarities of Australia, and that periods of drought follow seasons of plenty as surely as night follows day, it seems incredible that a Government should delay for a moment getting some such scheme as this started.

The benefits to be derived may be summarised thus:—

(*a*) Sheepowners in our extensive dry and semi-dry areas would be assured of an ample supply of good fodders in drought periods, at prices equal to about one-third of what they have to pay under the present conditions at such times.

(*b*) Farmers would be certain of a payable price for all their surplus products, making their calling very much less precarious than at present.

(*c*) A general feeling of security would be given to our financial institutions, which would extend to the whole State.

In conclusion, I venture to state that such a scheme is imperative to make the extra production derived from the locking of our rivers a complete and payable proposition, and that the two together will be of incalculable assistance in realising Sir Joseph Carruthers' grand objective of "A million farms for a million farmers."

A TYPICAL AMERICAN "BETTER WAY" CAMPAIGN.

THE American has an undeniable talent for propaganda, and having decided to educate the farmer as to the benefits of selecting seed maize in the field, the United States Department of Agriculture has set about the work in characteristically thorough manner. Indiana has been especially active in emphasizing the importance of every farmer "field-selecting" his seed maize from the standing stalks, says the *Weekly Newsletter*, and a report of the local county agent leader states that in one county a unique proposition was placed before the children in six rural township schools last spring. Each competing pupil and his father were to pick out the best bushel of seed maize to be found in the seed at home. This was to be planted on one side of a field for identification. In the autumn the pupil was to pick out thirty or forty ears from the standing stalks for seed, and later in the winter to bring the best ten ears to the local county school, where a show would be held. The best ten ears from each school were then to compete with those of the other schools of the township, and the best from the town with the rest of the county. The interest of no fewer than 639 youngsters was thus enlisted in the plant improvement movement.

Fodder Crops for Dairy Farmers.

Southern Tableland.

R. N. MAKIN, Inspector of Agriculture.

THE information herein has been compiled to assist those who desire to know the various fodder crops which might be grown under the conditions prevailing on the Southern Tableland. The time of sowing, &c., varies in different parts of the district on account of the variation in altitude, and local knowledge, which is generally available, will be found helpful. The times mentioned here must necessarily be approximate.

More attention should be given to the growing of fodder crops, and also to the pastures. The latter, indeed, should receive first consideration, but that is a matter not to be dealt with here. Where dairying is carried on fodder crops are absolutely necessary, being specially valuable in the winter months when other fodder is scarce and when prices for the products of the dairy are high. Where sheep are kept they are also of great value, particularly at lambing time.

In raising suitable crops to meet particular needs there are several factors to be reckoned with, the most important, perhaps, being the weather. The records compiled by the Government Statistician, covering a period of twenty to fifty years, show that the average rainfall varies from 19 inches at Cooma to 32 inches at Crookwell. If this rainfall were distributed so that good falls were assured in the spring and autumn the growing of crops would be simple, but such is not the case, and it is therefore necessary to practice a modified system of fallowing, by means of which soil moisture is stored and the ground is sweetened. On the tablelands a winter fallow for spring-sown crops cannot be too strongly advised, and a summer fallow for the autumn-sown crops would also be highly beneficial. After June or December rains the ground should be broken up, and, especially during the summer months, worked down with the harrows.

As autumn-sown crops are more varied and of the greater use they will be dealt with first.

Oats will be found doing best on the heavier class of soils—those holding plenty of moisture such as is found in the flats. Such soils are often very rich, and the crops on them are inclined to become rank. As the straw is likely to grow very coarse and to become rank, the straw growing very coarse and lodging often eventuating, the crops should be fed off during the winter months. If the crop is required for hay it is absolutely necessary to feed it off.

Algerian oats are mostly grown, being useful for feeding off and for hay. The crop is late in maturing in comparison with other varieties, and is a prolific stooler. Sunrise oats are fast coming into favour on account of their earliness and the bright straw. The variety is not a good stooler, so requires thicker seeding than Algerian. Guyra is also suitable, but seed is not plentiful yet.

On the lighter, drier soils, such as are found on hillsides, slopes, &c., wheat will do better than oats. In most places Cleveland will out-yield other varieties for grain and hay, but it is late in maturity. Marshall's No. 3, Marquis, and Yandilla King are other useful varieties.

Barley is not popular as a grain crop, but for green fodder Skinless, Trabut, and Cape are worth growing, Trabut being the hardiest. Rye is useful for feeding off only, Black Winter being the most reliable variety.

The sowing of field peas with the cereal when the crop is intended for green feed is strongly recommended. A mixed fodder consisting of peas and a cereal is of higher feeding value than the cereal alone, and is more palatable. The most useful variety on the market at present is Grey field peas. Peas are particularly useful when the crop is to be fed to pigs.

Of spring and summer-sown crops, maize is little grown, but now that quick-growing varieties have been introduced some attention might be given on account of the feeding value. Hickory King and Leaming are varieties well worth trying in the colder districts.

Japanese millet is most useful as a catch crop. Being tender, the plants will not stand frost, and the best time to sow is in December and January, those being the months during which the monsoonal rains generally occur. Given good weather conditions there is no crop that will make such rapid growth ; hay crops of this millet have been cut under three months from sowing, and yields of three tons per acre have been obtained under favorable weather conditions. All classes of stock are exceedingly fond of it, both in its green state and as chaff. It has wonderful grazing capacity, providing it is not allowed to get too high before being fed off, and if judiciously grazed it is wonderful the amount of feeding it will stand.

Rape is an excellent crop for sheep for feeding off. Berseem clover, field peas, or mustard improve the feeding value when sown with it. The same remarks apply to turnips.

Lucerne should be more grown. It will be frequently found that the slopes of hills will grow excellent lucerne. A dressing of superphosphate applied about July or August is highly beneficial, and a vigorous harrowing after every cut is productive of good results.

The main point in successful lucerne-growing is a deep soil. If a heavy clay subsoil or rock formation is close to the surface then try something else, but where the soil is deep and well drained try lucerne.

Red clover—Perennial Broad Red—should be grown on soils which are too heavy for lucerne—sticky black flats, wet patches that have been drained, shallow soils, &c. It is a plant that will grow well with other crops, and should be sown with all grass mixtures. When grown under suitable conditions, it will keep weed growth down, so strongly does it grow. Its feeding value is as high as lucerne. Under suitable weather conditions it will yield a heavy cut of hay early in the spring, and as a crop on which to graze lambing ewes it stands alone. It is sometimes called cow-grass.

Subterranean clover—so called on account of the habit of the seed heads of bending over into the ground and burying the seeds—is being sown largely and is certainly relished by sheep. It likes moist soils, and is at its best in the spring.

SOWING TABLE of Green Fodders, Southern Tablelands.

Crop	When to Sow.	Quantity of Seed per acre.	How best to Sow.	Available for Cutting or Grazing.
Wheat	March–May	Drilled, 90 lb. Broadcast, 120 lb.	Drill	May–August.
Oats	April–Sept.	Drilled, 60 lb. Broadcast, 80 lb	,,	May–November.
Barley	March–May	,, ,,	,,	May–August.
Rye	Feb.–May	Drilled, 60 lb. Broadcast, 90 lb	,,	March–August.
Maize (fodder)	Dec.–Jan.	Drilled, 30 lb. Broadcast, 56 lb	Rows 3 feet apart	February–April.
Japanese Millet	,, ,,	Drilled, 5 lb Broadcast, 8–10 lb.	Broadcast	January–April.
Rape	March–May	Drilled, 2 lb. Broadcast, 4 lb.	Drill rows, 2 feet 6 inches apart.	July–October.
Turnips	Jan.–May	,, ,,	Drill ,,	May–October.
Field Peas	Feb.–May	Drilled, 60 lb. Broadcast, 120 lb. With other fodders, 40–60 lb	Drill ,,	May–October.
Lucerne	Feb.–April	Drilled, 7–10 lb Broadcast, 15 lb.	Drill	September–May.
Per. Red Clover	Dec.–March	Drilled, 7–9 lb Broadcast, 12 lb	Broadcast	April–December.
Berseem	Jan.–May	Broadcast, 15 lb. With other Crops, 5 lb.	,,	March–November.
Subterranean Clover.	Jan.–April	Broadcast alone, 12 lb. With other Crops, 4 lb.	,,	April–December.
Mustard	Jan. May	With other Crops, ½ lb.	Drill	July-October.

Where artificial manures are required, 1 cwt. each of superphosphate and bonedust mixed, and sown at the rate of about 1 cwt. per acre drilled, or 2 cwt. broadcast, will be found most suitable for all the above crops.

North-western Districts.

MARK. H. REYNOLDS, Inspector of Agriculture.

THE problem of providing green succulent fodders for those periods of the year when the natural pastures are generally dry and sometimes deficient, is no less real in the north-western portion of the State than elsewhere.

It is convenient to consider the areas that mainly lie north-westward of a line running from Murrurundi to Tamworth, though the same recommendations would generally serve the country from Maitland to Tamworth. In normal seasons herbage such as crowfoot, trefoil, &c., produces an abundance of feed from autumn to early spring, and when early spring rains occur native and introduced grasses also luxuriate in the ensuing months. But for the six months, November to April, the herbage and grasses are generally dry, and it is often an advantage to have some fodder crop that will afford green feed during this period.

Lucerne.—First place for this purpose must certainly be given to lucerne, which is suitable for a great portion of the area, especially on the river flats and red lands ; over a large area of the plains country, when established, it survives all except drought periods. At least one, and sometimes more, good cuts of hay are procurable in the early spring on the uplands, and normally a green picking will also follow throughout the year, except in the months of January and February, when the heat and lack of moisture causes the plant to be stationary. In June and July also, the weather being cooler, the plant is found in a resting condition.

Sudan Grass.—In the past two years this fodder has been extensively tried and found most suitable. It can be grazed with minor risks by cattle, sheep, and horses, and generally one hay crop can be garnered during the season. It is killed off by frost, but where the winters are mild it will often come again in the spring.

Sorghums.—The varieties Milo, Kaoliang, and Feterita all do well, and in some ways are preferable to the fodder sorghums, chiefly on account of the abundance of seed of good feeding value which they produce in addition to quite a fair amount of fodder.

However, Saccaline, Early Amber Cane, and *Sorghum saccharatum* all grow well in the area, though they need to be fed with care and not under any condition supplied to stock until the flowering stage is reached.

Maize.—When grown for green fodder, satisfactory yields may be expected from maize. It should be sown early, either thinly broadcasted or in drills. Young maize will usually withstand mild frost, and it has the advantage over the sorghums of being harmless to stock at all stages of growth, but it is at some disadvantage in a dry period, as the crop makes a poor recovery compared with the sorghums.

Cereals.—Sowings in March of wheat, oats, or barley of any variety are justified as a safeguard against a poor growth of natural herbage under adverse seasonal conditions. Fed off from time to time they prove invaluable in maintaining stock in health and condition, especially as they usually remain green when the natural herbage has dried off.

Rape and Mustard.—Both these crops yield prolifically in other than dry autumns, but the season of growth approximates that of the natural herbage. It is not advisable to grow mustard where cereals such as wheat, oats, or barley, may be subsequently grown, for it is often difficult to eradicate.

Farmers are also warned against growing such crops as Johnson grass and other plants that produce underground stems, for their eradication is apt to be a costly matter.

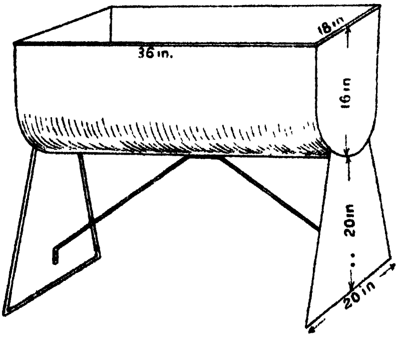
Root Crops.—Generally the climate is too warm for mangels, turnips, beets, &c., but where water is available for irrigation, or in a season of good rainfall they will yield prolifically if sown in the autumn. Their extensive growth is not otherwise recommended.

SOWING TABLE of Fodder Crops, North-western Districts.

Crop.	When to Sow.	Quantity Seed per acre.		How to Sow.	Available for cutting or grazing.
		Drilling.	Broadcast.		
Lucerne ..	April to June.	6 to 15 lb.	12 to 25 lb.	In drills 7 inch apart, or broadcast.	September in first year and any time after.
Sudan Grass .	Sept. to Jany.	4	10	For cultivation rows 30 inches apart, preferably drills 7 inches apart	When well in tassel, after being cut and wilted (at other times with some risk).
Sorghums .	Sept. to Jany.	4	10	Drilled 30 inches apart or broadcast.	When well in flower and seed.
Maize ..	Sept. to Jany.	12	24	Drilled 4 feet apart or broadcast.	At any time.
Bokhara Clover	March to May, August to Sept.	5	10	In drills or broadcast.	At any time.
Cowpeas ..	Sept. to Jany. with the crop.	12	20	,, ,,	At any time, preferably when in flower or pod.
Rape ..	Feby. to May.	3	6	,, ,,	At any time.
Mustard .	,, ,,	2	4	,, ,,	,,
Mangels, Beets, and Turnips .	,, ,,	4	8	,, ,,	When well formed in spring.
Wheat, Oats, and Barley .	Mar. to August.	50	70	,, ,,	At any time.

A HANDY WASH-UP VAT FOR DAIRYMEN.

THE wash-up receptacles to be seen in dairies are frequently of a very crude and nondescript character. Wooden vats soon become very insanitary and foul-smelling, and in this condition are unsuitable for the washing of dairy utensils. These vats have to be made with angles, and it is in the angles as well as the pores of the wood that dirt and filth accumulates.



The accompanying sketch shows a very useful and cheap vat made entirely of heavy (22 gauge) galvanised iron and heavy wire over which the edges are turned. Being movable it can always be placed when in use on the dairy wash-up verandah in a position to avoid the splashing and fouling of the dairy walls. A bath-plug permits of the easy disposal of the dirty water.

A point in favour of this vat is the rounded bottom, which gives the utmost efficiency to a given quantity of water. The vat from which these details were secured has been in use for over four years, and is still in excellent condition; it cost about £2 15s.—O. C. BALLHAUSEN, Dairy Instructor.

MAIZE HUSKS AS FEED FOR COWS.

ALTHOUGH maize husks cannot be seriously considered as a butter-producing fodder, they may nevertheless fill a useful place in dairying economy. Cows eat them readily, and beside supplying roughage they appear to provide chemical salts that are valuable in the maintenance of health. If in winter-time they are used to supplement a more concentrated diet they supply the bulk demanded by the cow for its digestion, and ensure her satisfaction and comfort for the night. Again, in early spring, when cattle are being grazed on young oats or barley and when grass is young and watery, maize husks have a tendency to correct any inclination to scouring, and at this season they will readily be eaten. The opinion held by many experienced dairy-farmers that the feeding of maize husks results in a richer cream is therefore in essence a sound one, though the influence is an indirect one; for cows that are properly fed and given a roughage that is at once palatable and satisfying are enabled to get comfortably settled in some sheltered spot and to rest. Rest is essential for milk production, and cows that have to hunt about in the cold to satisfy themselves do so to the detriment of the milk yield.

Maize stover is much more nutritious than husks or dry stalks, and is convenient to handle, but maize is useful in all shapes, from dry stalks to meal, and is probably our best fodder plant in dairying districts.—J. A. ROBERTSON, Herdmaster.

PARASITES OF OLIVE SCALE.

DURING the past season Mr. Luke Gallard, Orchard Inspector, has carried out further investigations regarding the life history of the Chalcid parasites that keep the brown bug or olive scale (*Lecanium oleæ*) in check in the County of Cumberland. He has bred out two generations of the scale, together with two broods of parasites, during the year.

He says: "On 5th October I noticed that a number of young scales which emerged in September had developed a soft covering. These I kept under notice till 10th January, 1922. They were then full grown and an occasional parasite had emerged. I collected 219 scales and put them away in a tube. From these I took about two dozen larvæ and pupæ, and afterwards bred 114 adult parasitic wasps, thus showing that a fresh batch of both scale and parasites had passed through a complete cycle between the middle of August, 1921, and the middle of January, 1922. From those which escaped being parasitised, the young were emerging freely on 25th January."

From these observations Mr. Gallard suggests that in spraying for brown bug the proper times would be the middle of September and the middle of February, when the young larvæ are emerging from the adult female scales.

Mr. Gallard also states that, in addition to the parasites noted in previous communications, he has bred another remarkable undetermined yellow species with banded wings extending well over the tip of the abdomen.—W. W. FROGGATT, Government Entomologist.

Summer Leguminous Crops.

COWPEAS, SOYBEANS, AND VELVET BEANS.

H. WENHOLZ, B.Sc. (Agr.), Inspector of Agriculture.

ON account of their high feeding value and of their utility for soil improvement, the annual leguminous crops, such as cowpeas, soybeans, velvet beans, and also peanuts, will always deserve a place in general farming and will yet come to be regarded as essential in any system of intensive farming in many districts of this State.

Generally speaking, these crops are not as particular in their soil requirements as many other crops, growing well on poor soils as well as on many acid soils to which clovers and lucerne are quite intolerant. These characters make these leguminous crops all the more valuable from a soil-improvement point of view, particularly as they have the power, in common with other legumes, of increasing the nitrogen in the soil.

The climatic requirements for the best development of these crops differ somewhat. Velvet beans are mostly late maturing and require a warm climate and a good rainfall to grow to maturity and produce an abundance of seed. The North Coast district, north of Sydney, must be regarded as the only part of New South Wales which answers these requirements, and the farther north along the coast the better.

Cowpeas require somewhat similar conditions, but can be grown well in other districts where the season is not so long, though warmth and moisture are still essential for their best development. The North and South Coast and favoured portions of the western slopes grow good crops, though their utilisation and value becomes less in the latter district because of the competition of other crops which are often more suitable for the purpose. On the far North Coast, velvet beans are too strong a competitor with cowpeas as a green manure crop.

Soybeans grow fairly well on the coast, but for green manuring purposes cowpeas compete too strongly for them to make much headway. Good results have, however, been secured from soybeans in the cooler tableland districts, where velvet beans and cowpeas are out of the question on account of the warmth and moisture they require.

Of the three crops, velvet beans will make the best growth on land too poor to grow cowpeas and soybeans well, though fertilisers, particularly superphosphate in small quantities, usually make a vastly increased growth of any one of them on such land. Soybeans are a little more resistant to dry weather than the other two crops, though none of them can be strictly called drought resistant.

While not regarded as main fodder crops in any district, they have decided uses in this direction which are very little known at present, but which, with their soil-improving qualities, will bring them gradually into prominence with the aid of suitable varieties, and rapidly so, as previously mentioned, in any more intensive farming system.

Apart from soil improvement each of these crops has its particular excelling sphere of utility—cowpeas as a purely hay crop, soybeans as a grain crop for pigs (particularly for hogging down) and also as an emergency hay crop, and velvet beans as a catch crop for winter grazing.

As hay crops, cowpeas and soybeans cannot compete with lucerne where this crop can be grown, but lucerne has its soil and climatic limitations, and it is here that cowpeas or soybeans are deserving of a place. Their hay is more difficult to cure than lucerne hay owing to the thicker stems, but it has the advantage of being actually less damaged by rain during haymaking. The following analyses show how favourably the hay compares in feeding value with that of lucerne or clover:—

PERCENTAGE of Digestible Nutrients.

Crop.	Protein.	Carbohydrates.	Fat.	Nutritive ratio.
Lucerne hay ..	11·0	39·6	1·2	1 to 3·9
Soybean hay ...	10·8	38·7	1·5	1 to 3·9
Clover hay ...	6·8	35·8	1·7	1 to 5·9
Cowpea hay ...	5·8	39·3	1·3	1 to 7·3

Soybean hay appears to be therefore about equal to lucerne hay and superior to clover hay, while cowpea hay is only slightly inferior to clover hay. The value of soybeans and cowpeas in this respect is not by any means well known.

COWPEAS.*

The cowpea is a summer-growing annual, more closely related to the bean than to the pea. It is not a true climber, having no tendrils, but the long vines twine around any adjacent support and cling to it.

Cowpeas are very tender, and are killed by even a light frost at any stage of their growth. During the summer and autumn they continue to grow and produce green pods (except in the case of very early varieties) until checked by frost or drought.

The crop grows well on the North and South Coast, and in favoured portions or under irrigation in the west.

Although sensitive to wet soil, cowpeas will grow on poorer soil or on a more acid soil than soybeans, but where the climate is suitable velvet beans will make better growth on poor soil than even cowpeas.

The land can be prepared in much the same way as for maize and other summer crops. Very early sowing is not to be recommended. It should be deferred till the soil is warm enough to germinate the seed rapidly, as otherwise it is likely to become mouldy and rot in the ground. As a rule the crop is sown in rows 2 feet 6 inches to 3 feet apart, and the seed from 6 to 9 inches apart in the rows. The amount of seed required per acre for sowing in rows 3 feet apart varies from 5 to 15 lb., according to the size of the seed of the variety grown.

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*The information on cowpeas has been revised and adapted from an article in the third edition of the "Farmers' Handbook."—H.W.

Varieties.

There are a very large number of distinct types of varieties of cowpeas. Of the large number imported at different times from India, America, and other places, a few only are in general cultivation. Of these the Black is the most popular, while the Poona, a variety introduced from India, has rivalled the Black at Hawkesbury Agricultural College. The following are the best varieties of the large number which have been tried up to the present by the Department:—

Black.—This, one of the best all-round varieties, is distributed more widely than any of the others. It is late maturing and semi-recumbent to recumbent in its habit of growth, and gives heavy yields of both greenstuff and pulse. The grain is large and black in colour, the pods from 7 to 8 inches long, and easy to pick. One of its chief qualities is the even ripening of the pods, which necessitates fewer pickings than do many of the other varieties.

Poona is a very late-maturing variety, which does not mature its pods as evenly as the Black, but which equals, if it does not excel, it in the production of green fodder. It is a distinctly upright-growing variety, thereby facilitating harvesting and cultivation, till the pods begin to form and the vines fall and block up the path between the rows. The seed is light brown and very small, the pods being only 4 inches long.

New Era is a medium early variety which produces a large bulk of green fodder and a heavy yield of seed. It is medium upright to slightly recumbent in its habit of growth, and the pods are very long and straight. The seeds are a bluish colour, marbled and dotted with brown. This is one of the best varieties for sowing among early maize, for, owing to its earliness, a quantity of seed can be picked before the heavy bulk of fodder is ploughed in.

Victor is the best of the new varieties. It is a little later maturing than the New Era, and makes a very good growth of fodder. It is the only variety of which seed is at present obtainable in the State and which is resistant to the attacks of eelworm, a troublesome pest on the North Coast. At Wollongbar in 1920 Victor easily surpassed all others, mainly on this account. The seed is fairly small, of a brownish colour, with dark-brown marbling tinged with crimson.

As a Green Manure.

Cowpeas form a very valuable green-manure crop for orchard and general farm work. Their deep-rooting and nitrogen-fixing propensities especially adapt them for this purpose. A good deal of difficulty is experienced in ploughing the vines in, and the use of the mouldboard plough, even with a good disc coulter, is only partially successful. It is the usual practice at the College to roll the crop first, and then, after running over it with a cornstalk chopper or disc cultivator, to plough it in with a single-furrow disc plough. The crop should be ploughed soon after the pods are set. At a later stage than this, the stems become woody and are hard to deal with.

As a Fodder Crop.

Ploughing the crop under in this manner is sometimes a very wasteful practice. It has a very high feeding-value, and if the crop be fed off on the ground where it is grown, at least 50 to 75 per cent. of the manurial value will be returned, while the full feeding-value of the crop will also have been obtained.

The growth of such crops as maize, sorghum, and millets, with the cowpea, is a very good practice. Such a mixture not only forms a better mixed ration for stock, but also increases the total produce.

The seeds of the legume and cereal are usually sown together in rows 2 feet 6 inches to 3 feet 6 inches apart, and there is a tendency for the cowpeas to climb the upright-growing crops—more particularly the sorghum and millet.

In rows, maize at 10 lb., sorghum at 6 lb. and millet at 3 lb. per acre mixed with 8 to 10 lb. of cowpeas per acre is about the usual quantity to sow.

A system that has proved very profitable on the North Coast is to sow the cowpeas down between the rows of early corn. They are sown with a maize dropper or broadcasted immediately after the last cultivation of the maize, which should not be later than January.

Undoubtedly the best plan of utilising the green crop is by feeding it off. Pigs take to it more readily than cows, but the latter can be accustomed to it. If it has to be cut and fed to stock either as green feed or as hay a pea-vine harvesting attachment should be used with the mowing machine.

The cowpea will make good hay, but although the hay is somewhat difficult to cure, it actually stands more rain during curing than many other hay crops. In the southern states of America cowpea hay is grown to a large extent as a substitute for lucerne hay, in a climate of abundant rainfall similar to our North Coast.

SOYBEANS.

A crop which is grown to the extent of 190,000 acres in the United States seems surely to merit some place in the agriculture of New South Wales, which in many parts is climatically similar to America.

For many years soybeans were tried on the North Coast and in other warm districts on the western slopes, but without any sign of success. From this failure it has been wrongly concluded that the climate of New South Wales is wholly unsuited to the culture of soybeans. Evidence is now available to the effect that it is in the cooler climates of the State chiefly that soybeans will be generally most successful. On the North Coast, both velvet beans and cowpeas are too strong competitors as green manures or even as fodder crops, with perhaps the exception of one outstanding variety of soybeans. Though resistant to a certain amount of dry weather, soybeans are not sufficiently drought-resistant to stand the long dry spells experienced during the summer in the western districts, except in favoured localities on the slopes.

Although killed by heavy frost, soybeans will stand a considerable amount of frost without injury, and have been already successfully grown on parts of the Northern, Central, and Southern Tablelands. The seed does not rot in cold weather nearly as readily as cowpeas, and will germinate well even when the weather is wet and cold in the spring. It is stated that in America some varieties (particularly the black-seeded varieties) will lie in the ground all the winter and germinate in spring, while cowpea seed exposed in this way quickly rots.

The Utility of Soybeans.

The soybean is one of the most important crops in China and Japan, and from those countries a large quantity of soybean oil is exported, some of which finds its way into Australia. The oil is a semi-drying oil (contained in the kernels to the extent of about 17 per cent.), which is used chiefly in the manufacture of paint and soap.

It is not, however, as a grain crop for this purpose that it is likely to make headway here. Apart from its value as green manure (being a legume, it maintains or increases the nitrogen of the soil also), the soybean excels mainly (1) as a grain crop for hogging down, on account of its heavy production of seed of very high protein and oil content and excellent feeding value, and (2) as an emergency hay crop on account of the high value of its fodder. As mentioned above, the hay is about equal in feeding value to lucerne hay and superior to clover hay, and it has the added virtue of being able to produce good crops of hay on soils too poor or too sour for clover or lucerne.

Unlike cowpeas, the soybean ripens all its seed about the same time; on the tablelands the best varieties take about four months to reach the hay or fodder stage, and about five months to mature seed.

One feature of the soybean crop is its comparative freedom from attacks of insects and diseases. Even the seed in storage is not affected by the bean weevil which infests cowpeas and other beans badly. Rabbits are, however, very partial to the crop even when plenty of other feed is available, which may be taken as an indication of the high palatability and feeding value of the crop.

Planting.

The best time to sow soybeans is about the time maize should be planted, or better slightly later. The growth is slow at first, and if sown too early, weeds may grow faster than the crop and the soybeans will be injured in the attempt to smother or otherwise deal with the weeds.

Soybean seed heats very quickly in storage (especially in a warm moist climate), and also loses its germinating power very quickly if kept for any length of time, especially over one season. When there is any doubt about the vitality of the seed, a test of the germination should be made or the seed should be sown thickly.

Above all, care should be taken to plant the seed only at a shallow depth —not more than 2 or 3 inches. Many disappointments have been caused by deeper sowing.

The rows should be about 2½ or 3 feet apart and the seed 4 to 6 inches apart in the rows, 5 to 12 lb. seed being required per acre, according to the size of seed of the variety. Sowing can be done with a maize-drill with a special plate, or with a wheat-drill by blocking up all but a few of the tubes.

The young plants have no ability to push through a crusted surface soil, and care should be taken to keep the surface loose by light harrowing before the plants come through.

Varieties.

Varieties of soybeans differ greatly in the length of time taken to mature, the nature of the growth, and the size, shape, and colour of the seed. As a rule the later maturing varieties grow more vigorously than the early varieties and usually give the best yields of fodder, though some of the earlier ones are good seed producers. For hogging down dual-purpose varieties are required, namely, varieties that will produce good yields of both fodder and seed.

Of the varieties tried so far in New South Wales the following seem to be best:—

Otootan.—This is a very late variety, which takes nearly the full season to mature for fodder on the tablelands, but the production of the seed is somewhat risky there. On the coast, however, it gives a good yield of both fodder and seed, even rivalling some of the cowpeas for fodder or green manuring. It is easily the best dual-purpose variety yet tested on the coast. The seed is very small, black, and elliptical in shape, with flattened sides.

Hollybrook is a medium late variety, but nearly a month earlier than Otootan, maturing safely for seed on the tablelands, where it is a good dual-purpose variety, giving a good yield of fodder and a very good yield of seed. The seed is small, of straw-yellow colour, and elliptical in shape.

Mammoth Yellow.—This is a variety of about the same maturity as Hollybrook, giving a good yield of fodder, but not such a heavy production of seed. The seed is small, round, and yellow.

Haberlandt is a medium early variety of very good seed-producing qualities, but not so good for fodder. The seed is of medium size, round, and yellow.

As Hay or Fodder Crop.

It is as an emergency hay crop that soybeans are destined to fill a place in our tableland agriculture.

The chief qualities possessed by this crop which make it well worth consideration in the tableland districts are:—

1. The high feeding value of the hay (nearly equal to lucerne hay and superior to clover hay).
2. The yield of hay obtainable in a short season of growth (1½ to 2 tons per acre being a fair average).
3. The distinct soil-improvement value of the crop when included in a system of crop rotation.
4. Its ability to make better growth on acid soils where clover fails.
5. Its emergency value in the utilisation of land; soybeans can be sown for hay after the best time for sowing clover or oats has passed.

The highest feeding value and the greatest palatability occur in soybeans just as the pods are forming, but when the pods are full grown nearly double the yield of fodder is obtained. The best time to cut for hay is when the seeds are about half developed. Some varieties have more persistent leaves than others, but in most varieties the leaves are usually shed completely when about half the pods are ripe or a little later.

For seed, the crop should be cut when about three-fourths of the pods are ripe. If left later than this a quantity of the seed may be lost by shattering.

The ordinary mower can be used for harvesting the hay and also for seed, though it is also possible in many cases to use the grain binder for the latter purpose. Threshing can be done with the ordinary grain thresher by making a few adjustments to avoid cracking the seed.

When soybeans are to be used for hogging-down or as a grain crop for use on the farm, they may either be sown alone or with maize. When sown alone an average yield of 15 to 20 bushels per acre may be expected. Yields have been recorded in America of up to 35 bushels per acre. Hogging-down maize is not practised here to anything like the extent that is done in America, but on the upper reaches of some coastal rivers where it is in vogue the planting of soybeans with maize would make the feeding value of the combined crops much greater than the maize alone. Planting soybeans in the same rows as the maize will not generally reduce the yield of maize appreciably, and any reduction may be expected to be more than made up for by the yield of soybeans. Alternate rows of maize and soybeans decrease the yield of maize still further, but counterbalance this by the increased yield of soybeans.

For many parts of the coast where pig-raising is conducted small areas of soybeans alone of the most suitable varieties are recommended for trial as a concentrated grain food (combined with the fodder for hogging-down) of extremely high feeding value, being exceptionally high in protein and fat. As a combination crop with maize for silage, soybeans are also becoming largely grown in America.

VELVET BEANS.

The velvet bean is practically unknown in New South Wales as a farm crop, yet in the southern states of America it is very largely grown, and in South Africa it is stated to be "without exception, the most important crop introduced into Rhodesia."

On the North Coast, where the climatic conditions most suit this crop, one cannot but be struck with the extremely copious growth it makes, easily outyielding any of the cowpeas and soybeans, and being especially capable of making good growth on land too poor to grow cowpeas successfully.

When grown on an experimental scale, this vigorous growth of the velvet bean has been observed more in the light of a valuable green manure or cover crop, and little is apparently known of the plant here as a fodder crop. In the other countries mentioned, velvet beans are valued very highly as a palatable and nutritious stock feed—especially for cattle and pigs.

Valuable Winter Pasture.

It is as a winter pasturage that the velvet bean excels. Even with the cold winters experienced in America it is stated that velvet beans will remain in the field all through the winter, weather conditions having such little harmful effect on the vines, leaves, and pods. With the shortage of feed during the winter particularly in the specialised dairying districts on the far North Coast, where paspalum is chiefly relied on and where little winter fodder is grown, velvet beans seem destined to fill a place as a cheap winter feed for cattle, especially with the appeal they make on account of their ease of handling as a winter grazing crop. Leguminous fodders should be welcomed here on account of the shortage of protein in the usual farm-grown feeds, and the recognised necessity for its purchase in the form of bran, oil meal, &c., and the velvet bean is well worthy of a trial.

The usual practice in the southern states of America is to sow velvet beans in the maize crop. Owing to the immense growth made by the velvet beans, sowing at the same time as maize in the same rows is undesirable owing to the velvet beans pulling down and smothering the maize stalks and rendering the harvesting of the maize difficult or impossible. After fifteen years' experience, the Massachusetts Experiment Station found that the ideal method was to sow two rows of maize 3 feet apart to one of velvet beans sown six weeks later than the maize. By this means the best of the maize can be pulled with little trouble when mature, leaving the nubbins and the velvet bean fodder for winter grazing.

The amount of grazing afforded depends on the growth of the velvet beans and on the amount of maize not harvested, but the Massachusetts Experiment Station states that it is the custom to allow one-third or one-half acre per month per cow. A good picking for pigs is also afforded from the trampled vines and beans if they are allowed to follow the cattle.

Velvet Beans for Seed.

Only on the North Coast is it possible to get velvet beans to mature a good crop of beans, and the value of these as a concentrated feed entitles them to some consideration.

Seed may be harvested from the field sown with maize, as mentioned above, before stock are turned in, or a separate small field may be sown specially for seed. If the latter method is adopted, the beans may be planted in rows 3½ or 4 feet apart, and 15 to 18 inches apart. This will require 12 to 15 lb. seed per acre. The average yield of seed is about 1,000 to 1,500 lb. per acre. The weight of unthreshed seeds in the pod will be about double this.

For feeding purposes the seed need not be threshed from the pods, the usual method of feeding being to use pods and all, either soaked for twenty-four hours or crushed into velvet bean feed or meal.

Velvet Bean Meal.

It seems possible that for the average farm the soaked pods will be the best form in which to make use of the high feeding value of the seed at the least expense. Considering the fact that large quantities of bran are bought to supply protein at present by North Coast dairymen (particularly in the far North Coast—the big scrub country), the composition of velvet bean meal and the results obtained from its use in America and other countries should be of interest.

The following comparison with wheat bran is given:—

	Ash.	Crude Protein.	Fibre.	Nitrogen-free Extract.	Fat.
Velvet bean meal . .	4·5	20·3	16·5	54·5	4·4
Wheat bran . . .	7·0	17·8	10·7	59·6	4·9

It will be seen that the chemical composition of velvet bean meal resembles that of wheat bran. It is slightly higher in protein, but contains a little more fibre.

As the result of feeding experiments at the Massachusetts Agricultural College, where digestion studies were also made, velvet bean feed was found to contain about 130 lb., or 11·5 per cent., more digestible nutrients per ton than wheat bran, and in two feeding experiments cows receiving a velvet bean ration produced an average of 5 per cent. more milk than on a wheat bran ration.

At the present time some tests are being conducted at Wollongbar Experiment Farm as to its feeding value compared with wheat bran under our conditions, and the results of these will be awaited with interest. The yields obtained per acre and the cost of harvesting will determine whether it is more profitable to feed a home-grown concentrate like velvet bean meal (or soaked beans) than to purchase wheat bran.

Value for Soil Improvement.

The value of the velvet bean for soil improvement also must not be overlooked. The increase in the nitrogen and humus content of the soil is reflected in better yields in the various crops. In America an increase of 12 bushels of maize per acre is recorded after velvet beans, while up to 20 bushels increase per acre has been made in Rhodesia after green manuring with velvet beans. Appreciable increases in the yield of the subsequent crops should also follow after velvet beans are utilised for winter grazing. Velvet beans are also suitable for sowing with maize for ensilage.

The Chinese variety is the best of those tried up to the present in this State.

AUSTRALIAN WHEAT IN DEMAND.

"THE Italian market for Australian wheat is a very active one" writes the *Mark Lane Express* of 20th February, 1922. The Australian product, in fact, seemed to be replacing the Russian, "which once was bought by Naples and Genoa so freely for making macaroni and other forms of hardened wheat food. The beautiful colour and level quality would recommend it, and its want of intrinsic hardness is, we believe, now met by the processes of baking and preparation."

HERD COMPETITIONS IN DENMARK.

ONE way in which improvement of dairy cattle has been effected in Denmark, writes Harald Faber, Agricultural Commissioner to the Danish Government, in an article in the *Journal of the Ministry of Agriculture* (London), has been by the holding of competitions between entire herds, the object being to find herds which not only contained prominent animals but consisted of families of such, and from which a supply of good breeding animals could be obtained for the improvement of other herds. The first competition was held in Funen in 1894-96 and the seventh in 1913-15. The herds were judged according to yield of milk, both by quantity and quality, and yield of butter (calculated from the yield of milk and percentage of fat), together with records of the amount of fodder consumed and records of descent of and relationship between the animals. The best herds were awarded prizes and were officially recognised as "breeding centres."

As indicating the progress made in breeding dairy cattle the following table is of interest. It gives the average yields of the herds entered in the first, fourth, and seventh two-year competitions in Funen. At these three competitions, seven, eighteen, and ten herds respectively were entered, covering 530, 777, and 304 cows respectively. The results are the average for *all cows*, and include heifers, cows that did not calve during the two years, and cows not in milk.

	Yield of Milk.	Percentage of Fat.	Yield of Butter.
	gallons.		lb.
1.—1894 96 ...	697	3·44	266
2.—1903-05 .	853	3·53	334
3.—1913-15 ...	934	3·83	398

These two-year competitions between entire herds comprising all the cattle on the farms are a special Danish feature They were in 1897 acknowledged to be of so great importance that the Government gave an annual grant of £4,000 for four years, of which as much as £150 a year could be paid to the best breeding centres This was an encouragement in a double sense. It was a reward to the good breeder, and it showed the farming world in general how much importance the Government attached to these competitions. Many more herds were therefore entered, and the state grant became superfluous and was withdrawn, except so far as to cover the cost of administering the competitions.

COLD STORAGE OF STRAWBERRIES.

WHEN the preservation of the fresh fruit flavour of strawberries is desirable, writes G. M. Darrow in United States *Farmers' Bulletin*, 1028, the following method may be used for packing small quantities for use when they are not in season. Select sound, ripe berries; wash and hull. Use a tin of convenient size to which a tight cover can be fitted. To each 10 lb. of fruit use one cup of sugar. Fill the cans with sugar and berries, put on the tops and cover their edges with adhesive tape such as is used in sealing packages, put in freezing cold storage and keep frozen until wanted. This product can be used for confectionery, by restaurants and hotels, for crushed fruit at soda fountains, and by ice cream manufacturers.

The Testing of Pure-bred Cows in New South Wales.*

L. T. MacINNES, Dairy Expert.

FROM a dairy-production view point the season ending 28th February, 1922, has been of the best. Pastures responded to the high rainfall and grew well, and in addition, breeders continued the practice of supplementing that class of feed with other rations.

The records for the past year both individually and judging by standard age averages compare very favourably with those of any previous year. Representatives of the Milking Shorthorn, Illawarra, Guernsey, and Friesian breeds have put up very high records, breaking fresh ground both for milk and butter-fat yields.

Review of the Year's Work.

NUMBER of privately-owned and Government cows tested.

Breed	Total number tested.			Number reaching standard.			Number below standard.			Percentage of those below standard to total tested
	Private.	Government.	Total.	Private.	Government.	Total.	Private.	Government.	Total.	
Milking Shorthorn	188	25	213	156	20	176	32	5	37	17
Illawarra ..	173		173	141		141	32	..	32	18
Jersey . .	98	23	121	87	19	106	11	4	15	12
Guernsey .	30	25	55	29	19	48	1	6	7	12
Ayrshire . ..	32	22	54	29	17	46	3	5	8	14
Friesian .. .	19		19	18		18	1		1	5
Red Poll . .	..	5	5		2	2		3	3	60
	540	100	640	460	77	537	80	23	103	16

The number of privately-owned cows completing the official test (540) is ninety-nine above the total for the year 1921. The greatest advance is shown in the Jersey breed with forty-five—a marked contrast to the position last year. Milking Shorthorns likewise show an increase of forty-five: Ayrshires on the other hand have decreased by twenty. The number of Government cows completing the same period or reaching the required standard under 273 days was 100, being nine more than last year. The total number of private and Government-owned cattle tested for the official period or reaching the standard under 273 days was 640, as against 532 last year, an increase of 108 (20 per cent). The total number (private and Government) undergoing test on 1st March, 1920, was 473; for 1921 it was 524, and this year 738—a marked increase. The number withdrawn during the year without completing their tests was 136, as against 173 during the previous twelve months.

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* Extracted from the official report presented to the annual meeting of the United Pure Bred Dairy Cattle Breeders' Association of New South Wales, covering the year ended 28th February, 1922.

The total number of records of cows tested for the official period of 273 days is as under:—

Number to 1918	1,547
„ during 1918–19	170
„ „ 1919–20	429
„ „ 1920–21	532
„ „ 1921–22	640
Total to 1st March, 1922 ...	3,318

The total of 3,318 includes both Government and privately-owned stock. In addition, a large number of animals have been tested each year, which for various reasons were withdrawn from test before the expiration of the official period, or without reaching the official standards for that period. These now amount to 1,099. With this addition, the total number of cows of which full or partial records are available comes to 4,417.

NUMBER of privately-owned cows completing tests of 273 days.

Breed.	Prior to 30th June, 1917.	Year ending 28th February.					Increase at 1922 over 1921.
		1918.	1919.	1920.	1921.	1922.	
Milking Shorthorn .	147	44	48	120	143	188	45
Illawarra	...	..	6	103	150	173	23
Jersey	579	19	28	59	53	98	45
Guernsey	37	7	9	18	23	30	7
Ayrshire	34	14	20	44	52	32	( ) 20
Friesian	...	. .	13	21	20	19	(—) 1
Total	797	84	124	365	441	540	99

In 1920, 101 cows (23 per cent.) failed to reach the standard in 273 days; in 1921, the number was 118 (22 per cent.); this year it was 103 (16 per cent.)

As stated in last report, the majority of breeders who commence to test do not fully appreciate the need of hand-feeding stock; but watching the test results soon educates them in this phase of their work. This is borne out in this year's figures. Although the number of cows tested is 108 more than in 1921, the total that failed to reach the standard is fifteen less. Faulty management and feeding give many a cow an undeserved bad record.

NUMBER of privately-owned herds tested to 1922.

Breed	1918.	1919.	1920.	1921.	1922.	Increase—1922 over 1921.
Milking Shorthorn ...	4	13	18	24	24	.....
Illawarra	2	10	19	29	31	2
Jersey	4	10	14	12	19	7
Guernsey	1	5	7	6	4	(−) 2
Ayrshire ..	1	3	7	5	5	......
Friesian	1	2	3	3	3	...
Total	13	43	68	79	86	Net gain 7

There is to be noted a small increase of seven in the number of herds submitted to the test. Although the average number of cows in each tested stud has considerably increased, the position cannot be regarded as satisfactory until the number of herds being submitted represents a far larger percentage of the owners who have stock entered in the various dairy herd books.

Features of the Year's Testing.

The individual performances of several cows during the year merit special reference. Last year mention was made of the record performance of the Milking Shorthorn cow, Melba XV, for 273 days, and it was forecasted she would put up a 365-days record also. This anticipation proved correct, as in the 365 days she produced 21,635·5 lb. milk, 954·472 lb. butter-fat, equal to 1,149·96 lb. of estimated commercial butter on the basis of 83 lb. fat to 100 lb. butter. This establishes a world's record for this breed. Melba XV's dam, Melba VII, gave 1,021½ lb. commercial butter in 365 days.

Melba XV having failed to produce a live calf eighteen months after the date of the previous calving, became ineligible to win the prize of £100 offered by the Department of Agriculture for the cow producing 830 lb. butter-fat or the greatest amount of butter-fat in excess of that minimum, to be given in 365 days in any one testing year. Two other cows gave the required yield of butter-fat and also calved within the specified time, viz., Rascal II of Thornleigh, owned by Mr. J. T. Whipps, Alstonville, Richmond River, and Pigeon and Upton, owned by Mr. H. Daley, Alstonville, Richmond River. The yields of these two cows of the Illawarra Milking Shorthorn breed and that of Melba XV, are as follows :—

THREE 1,000-lb. COWS.

Name of Cow.	Date of First Test.	Age.	Date of Last Calving.	Yield.			Estimated Commercial Butter.
				Milk.	Average Test.	Butter-fat.	
	1920.		1920.	lb.		lb.	lb
Melba XV ..	9th May ..	4 years 8 mths.	28th April .	21635½	4·4	954·47	1149·96
Rascal II ..	16th Sept. ..	7 ,,	25th August	15738	5·5	861·99	1038·55
Pigeon ..	12th August	9 ,,	26th July .	17668	4·7	837·96	1009·6

This has been a year of big records, not only for the extended period of 365 days, but also for the 273-day official period. The Illawarra Fairy of Fairfield (Alexander Bros.), gave 21,972¼ lb. milk, 786·17 lb. fat, equal to 947·2 lb. commercial butter, establishing a new Australian record for milk production; Starlight of Upton (Mr. H. Daley), 16,159 lb. milk, 734·52 lb. fat, 884·97 lb. commercial butter; Duchess of Fairfield (Alexander Bros.), 18,277¾ lb. milk, 658·29 lb. fat, 793·12 lb. commercial butter. The Government-owned Guernsey cow, Hope of Wollongbar, also gained distinction this year by producing 13,417 lb. milk, 800·01 lb. butter-fat, 963·87 lb. commercial butter.

While nothing under 700 lb. butter-fat in 365 days has been specially mentioned in the last paragraph, a line may be drawn at 500 lb. butter-fat for a 273-day record, and the number who have reached this high standard for special mention is a feature in our progress that is worthy of note. A few years ago special reports were written of cows giving 400 lb. fat in 365 days; to-day that figure is about the average for that period.

SPECIAL Yields for 273-days Tests.

Breed	Name of Cow.	Owner.	Milk.	Butter-fat.
			lb.	lb.
Milking Shorthorn	Empress (aged) ...	W. H. Dudgeon	12,732½	517·89
Illawarra ...	Rascal II	J. T. Whipps ...	13,317	711·24
„	Pigeon	H. Daley ...	14,617½	683·86
„	Fairy	Alexander Bros. ...	18,660	649·9
„ . .	Duchess	„ .	15,852	571·64
„	Susie II	J. J. King ...	11,605	563·65
„	Bud	J. T. Whipps ...	10,411½	524·09
Guernsey	Betsy III of the Vanquedor.	E. P. Perry... ..	11,185½	542·29
„	Hope	N S.W. Government	11,214	655·01
Friesian	Woodcrest Johanna Tehee.	E. L. Jones... ...	20,601	689·31
„	Woodcrest Netherland Queen.	„	18,013½	572·14

The number of cows, Government and private, giving over 10,000 milk and over 400 lb butter fat in or under 273 days, was as follows:—

Breed.	Over 10,000 lb. milk.	Over 400 lb. butter-fat.	Total.
Milking Shorthorns ...	10	Private 10... ...	10
Illawarras	11	„ 20... ...	20
Jerseys ..	...	„ 7... Government 2	9
Guernseys	2	Private 2 ... Government 4	6
Ayrshires	2	Private 2	2
Friesians	7	„ 3	3
	32		50

Last year the figures in this respect were twenty-four giving over 10,000 lb. milk, and thirty giving over 400 lb. fat.

High Average Tests.

Considering the amount of milk given, the Illawarra Rascal II again shows a high average test for her breed, viz., 5·5 per cent.; as also Nellie of Nestlebrae with 5·6 per cent., and Maude of Dulcet Grange with 5·4 per cent., both Illawarras.

Among the Jerseys, Flower of Yaralla with an average test of 6·3 per cent., 7,476 lb. milk, Retford Coulisse with 6·3 per cent., 6,256½ lb. milk, Gentiana with 6·5 per cent., 7,137 lb. milk, Retford Valentine with 6·6 per cent., 5,409 lb. milk, Dorothy, with 7 per cent., 4,186½ lb. milk, Retford Deer with 6 per cent., 10,054 lb. milk, Retford Melvina 6·9 per cent·, 6,787½ lb. milk, Desdemona of Wollongbar with 6·2 per cent., 6,353½ lb. milk, Moorilla with 6·4 per cent., 6,046½ lb. milk, are noticeable.

The Guernsey, Hope of Wollongbar, with an average test of 6 per cent. for the big yield of 13,417 lb. milk also merits attention.

Cost of Testing.

The losses borne hitherto by the Department through testing stud stock at the nominal fee of 5s. a head per annum had to be reviewed towards the latter part of the year, owing to the stringent financial position. With the concurrence of the United Breeders' Council, the fees for testing private stock have been raised to 35s. per head, or should the actual cost come to less than £3 10s. a head, the charge to be half whatever the amount is. At the same time steps are being taken to provide for a larger number of cows being tested at each stud. Provided breeders continue testing, this should reduce the average cost and result in the fee now charged being reduced. The raising of the fees came as a shock to breeders, especially as prices for dairy produce and stock are ruling so low.

It should be remembered, however, that testing provides the cheapest, most efficient, and quickest means of advertising. Without the aid of the test records, new breeders would have to spend great sums of money in advertising, and even then the process of getting to the front rank would be slow and laborious, whereas we have seen during the past year the names of many new men brought prominently before buyers in all parts of Australasia at the cost of a few pounds spent in testing. The test records are published every month in all States, and the annual report is sent by the hundred all over the world, wherever dairying is carried on. If any breeder spent hundreds of pounds each year in advertising through journals and the press, he could not get the same results as are now got by testing and by the official publication of his records. Breeders would be wise to look on the fees charged for testing as being part of the cost of advertising their stock.

If all those now testing will continue submitting all cows to be recorded once, at the same time using every endeavour to bring in their neighbours who are not testing, the cost for all will be materially reduced. The cost of testing Government cows will, from the 1st of March this year be calculated apart, so that the actual cost of testing privately-owned cows can be ascertained.

Herd Testing Associations.

The testing of ordinary herds by means of co-operative testing associations controlled by the members made good progress during the year, but it looks as if the movement may suffer a serious setback during the coming twelve months. At the end of February thirty-two units were operating, testing some 35,000 to 40,000 cows, as against eleven units, with 10,000 cows last year, and eight units with 8,000 cows in 1920. These testing associations have been started at intervals right along the coast. There are now six at work south of Milton. The low prices for dairy produce have had a deterrent effect in many centres on members rejoining for another year. This is strange, for the best way to cope with low prices is to get high yielding herds, and to get those, testing is necessary in order to cull out the low producers and replace them with better heifers. It would seem that many farmers prefer to go under rather than get rid of the animals that are keeping them down; or is it that they are not financially strong enough to bear even the small annual expense of testing?

An endeavour has been made during the last few months to get the great dairy farmers' organisations like the Primary Producers' Union to take an active part in the formation and conduct of herd testing associations. This matter is still under consideration, but something should be done immediately, otherwise the strenuous work of past years will be lost. The testing of ordinary herds is a matter of paramount importance to stud breeders. The members of testing associations should appreciate more than any others the value of a pure-bred sire of high production strain, and by the spread of such testing units, those breeders who have production records for their sale stock should reach a wider and better market.

Low Prices for Stud Stock.

The low prices received by breeders of pure-bred stock of high production strains is a matter of prime moment at the present time. The cost of building up and maintaining a herd is very great, and the prices obtained for young bulls, &c., in Australia is far below their value. A strong, well directed campaign is necessary to bring before the buyers the value of the better bull, and how cheap he is at hundreds of pounds compared with the non-productive animals at tens or twenties. Unless something is done to make stud breeding more payable, many stud owners will have seriously to consider their position.

Average Yields of Privately-owned Stock (273 days' test).

In the class 4 years and over, the average production of all breeds again shows an increase over that of the last two periods. In the 3 year and under 4 class, a similar increase is noted. In the class under 3 years there is an increase as compared with 1921, but a decrease as compared with 1920.

AVERAGE Yields of Privately-owned Cows.

Breed.	Average Yields.			Equal to or above Standard.		Yields in fat.	
	Milk.	Butter-fat.	Average Test.	No. of Cows.	Excess average fat.	Lowest.	Highest.
Four years old and over: Official standard, 249 lb. butter-fat in 273 days.							
	lb.	lb.	per cent.		lb.	lb.	lb.
Milking Shorthorn ...	7,392·3	297·7	4·03	83	48·7	145·89	517·89
Illawarra	7,775·7	324·9	4·18	73	75·9	179·26	711·24
Jersey	5,821·7	314·9	5·41	46	65·9	175·84	491·55
Guernsey	7,414·9	344·2	4·64	17	95·2	249·41	542·29
Ayrshire	8,270·7	332·7	4·02	11	83·7	233·9	401·64
Friesian	12,336	410·2	3·33	8	161·2	234·12	689·31
All breeds ...	7,416·7	317·1	4·27	238	68 1	145·89	711·24
Three years and under 4: Official standard, 207 lb. butter-fat in 273 days.							
Milking Shorthorn ...	6,390·7	263·8	4·13	18	56·8	189·67	334·84
Illawarra	6,222·8	268·1	4·31	14	61·1	121·19	490·03
Jersey	5,499·1	292·2	5·32	13	85·2	199·09	429·92
Guernsey	5,515·9	264	4·79	7	57	210·63	345·14
Ayrshire	6,720·1	275·9	4·11	4	68·9	185·13	440·5
Friesian	9,411·6	311·2	3·31	4	104·2	224·62	374·57
All breeds ...	6,270·6	274·6	4·38	60	67·6	121·19	490·03
Under 3 years: Official standard, 166 lb. butter-fat in 273 days.							
Milking Shorthorn ..	5,719·3	232·1	4·06	38	66·1	136·05	344·25
Illawarra	6,218·3	253·7	4·08	37	87·7	166·56	384·72
Jersey	4,242 7	220·3	5·19	21	54·3	170·54	360·79
Guernsey	4,322 9	200·8	4·64	4	34·8	151·93	255·09
Ayrshire	7,077	284·5	4·02	9	118·5	222·89	354·71
Friesian	8,100·8	284·6	3·51	3	118·6	259·83	326·87
All breeds ...	5,717·9	241	4·22	112	75	136·05	384·72

Average Yields of Government Stock (273 days' test).

In the class 4 years and over there is a slight increase over 1921 figures. In section 3 years and under 4, the average shows no difference, while in the class for under 3 years there is a decrease.

AVERAGE Yields of Government Stock.

Breed.	Average Yields.			Equal to or above Standard.		Yields in fat.	
	Milk.	Butter-fat.	Average Test.	No of Cows.	Excess Average fat.	Lowest.	Highest.
Four years and over: Official standard, 249 lb. butter-fat in 273 days.							
	lb.	lb.	per cent.		lb.	lb.	lb.
Milking Shorthorn...	7,143·8	271·2	3·8	10	22·2	234·82	313·28
Jersey	5,915·3	294	4·98	13	45	208·45	423·45
Guernsey	5,713·9	307	5·37	15	58	203·94	655·01
Ayrshire	6,748·3	265	3·93	10	16	135·33	363·82
Red Poll	5,725·5	218·8	3·82	1	30·2	147·96	281·28
All breeds ...	6,343·9	287·3	4·53	49	38·3	135·33	655·01
Three years and under 4: Official standard, 207 lb. butter-fat in 273 days.							
Milking Shorthorn...	5,062	213·1	4·2	1	6·1	201·28	235·45
Jersey	4,366·7	221·1	5·06	2	14·1	165·51	295·71
Guernsey	5,358·8	263·7	4·92	6	56·7	240·67	279·35
Ayrshire	6,431·4	250·3	3·89	4	43·3	209·61	287·84
All breeds ...	5,325·4	241·6	4·54	13	34·6	165·51	295·71
Under 3 years: Official standard, 166 lb. butter-fat in 273 days							
Milking Shorthorn...	4,660·2	185	3·97	9	19	161·83	231·97
Jersey	4,059·9	221·2	5·45	4	55·2	184·14	302 34
Guernsey	4,544·2	228·7	5·33	8	62·7	164·13	261·99
Ayrshire	4,610·8	188·1	4·08	3	22·1	137·5	225·46
Red Poll	4,527	192·7	4·3	1	26·7	192·7	192·7
All breeds ...	4,525·3	204·9	4·53	25	38·9	137·5	302·34

Summary of Production Standards.

The following table shows the average yields of all Government and privately-owned cattle that have completed the 273-days tests during the last three years, compared with the official standards for the different ages:—

Class.	Official Standard.	1919-20.		1920-21.		192 -22.	
		Average Yield.	In excess Standard	Average Yield.	In excess Standard.	Average Yield.	In excess Standard.
	lb. fat.	lb. fat.	lb. fat.	lb. fat.	lb. fat.	lb. fat.	lb. fat.
4 years and over ...	249	284	35	298	49	302·2	53·2
3 years and under 4 ...	207	260½	53½	232	25	258	51
Under 3 years	166	246	80	255	89	223	57

It will be seen that there has been a substantial increase in the average yields of both milk and butter-fat in all age-classes except that for the heifers.

Some Feeding Experiments with Allegedly Poisonous Plants.

MAX HENRY, M.R.C.V.S., B.V.Sc.

THE experiments to be detailed in the following series have all been negative, but they are of interest because in all cases but one there existed more or less circumstantial evidence that the plants were incriminated in stock mortality, and they serve to show what has been often pointed out before, namely, that it is never safe to condemn a plant as toxic on such evidence alone. On the other hand, it is unwise to deny the possibly poisonous nature of plants without experimentation, when observant and careful stockowners regard them with suspicion, as has been well shown in recent work by Dodd and Henry (this *Gazette*, May, 1921, vol. xxxii, p. 327, "Staggers or Shivers in Live Stock,") in connection with mallow (*Malva parviflora*).

It may be argued that the results of negative experiments are hardly worth publishing, but this view is a short-sighted one for unless publicity is given to such results, assertions of the toxic character of many of our native and introduced plants are repeated over and over again in text-books and elsewhere until they are finally firmly believed in. When mortality in stock occurs in association with such plants the belief leads to a ready but erroneous interpretation of the facts, so that the true reason for the mortality is often disregarded. Further, the business of dealing with noxious plants throughout the State is not likely to be placed on a satisfactory footing until we have ascertained by experiment and placed on record the true facts in regard to each plant.

It is not suggested that these experiments prove that the plants are never poisonous. Climatic and regional influences may possibly be a factor in determining their toxicity; the physiological condition of the animal may influence the effect of various plants upon it, and it is also possible that the poisonous principle of some plants may vary in potency because of the influence of the other food which the animal is receiving. It is, however, suggested that before any of the plants to be referred to below are regarded as toxic something more than circumstantial evidence is required. The results are held to indicate the desirability of further experimental work with these and other plants.

Throughout the experiments frequent identifications of plants were made by the Government Botanist (Mr. J. H. Maiden), who was also good enough to supply the descriptions of plants where they are given.

I.—*Solanum esuriale.*

Solanum esuriale, Lindl. in Mitch. Three Exped, 11, 43.—A low shrub often under 6 inches high and rarely exceeding 1 foot, the branches inflorescent and both sides of the leaves covered with a close but dense and soft stellate tomentum, rarely somewhat looser underneath. Prickles few and slender on the stems or the whole plant unarmed. Leaves petiolate, ovate oblong, or lanceolate, obtuse, entire or sinuate-toothed, mostly ¾ to 1 inch long, but in luxuriant specimens narrow-lanceolate entire and 2 to 3 inches long. Flowers solitary or two to four together, on a very short lateral common peduncle, the pedicels lengthening to ½ inch. Calyx under two lines when in flower with narrow almost acute teeth, enlarged after flowering and dividing into triangular acuminate lobes. Corolla blue, ½ to ¾ inch diameter, deeply lobed. Anthers tapering upwards. Berry globular. (Bentham's "Flora Australiensis," IV, 454).

In this *Gazette*, for January, 1898, Vol. ix, p. 37, Mr. J. H. Maiden quotes Stock Inspector Mackay, of Wanaaring, regarding this plant thus: "Does kill cattle wholesale, and cattle that have been on the station for years." As against this, however, it is on record that the fruits were eaten by the natives, and Mr. Maiden was evidently very dubious as to its poisonous qualities. Bailey and Gordon include it in their "Plants Poisonous to Stock," but state that it was not reported as poisonous in Queensland. Cleland, in his Report of the Bureau of Microbiology, 1912, quotes Maiden and Bailey and Gordon, and adds a reference from the *Stock and Station Journal*, 13th December, 1912, stating that the plant was held to have caused the death of 1,100 out of 5,000 sheep travelling between Menindie and Cockburn.

In January, 1920, a mob of cattle, moving from drought country, and very hungry and thirsty, came on a large patch of this plant in a green flourishing condition near Broken Hill, and gorged themselves. They were afterwards watered and seventy died in two days. Many others recovered after a period of profuse scouring. Inspector Johnston, of Broken Hill, advised the removal of the cattle from water, which measure appeared to check the mortality.

The following experiments were carried out with this plant in the Nyngan district in February, 1920 and 1921:—

1. Two merino wethers in good condition, were penned and fed for three days on Sudan and other grasses and herbage. They were provided with water throughout. They had recently been brought back from agistment at Sydney, and were in apparent good health.

A very hot spell had been experienced the week before the experiment; the season had been very bad up to January, when rain fell and a very rapid growth resulted towards the end of this month. When the experiment commenced the *Solanum* was growing freely and seeding prolifically, most of the seeds being full, round and green, a few turning yellow. On February, 1920, all feed was cleared out of the pen and *Solanum* fed as shown in the table on the next page.

TABLE showing amounts of *Solanum* fed.

Date.	Time.	Amount fed.	Remarks.
(1920).		lb.	
21st February ...	8 a.m.	1½	Sheep ate sparingly.
21st " ...	5 p.m.	1½	Eaten readily.
22nd " ..	7 a.m.	3½	Eaten readily, both leaves and berries. All previously given, eaten.
22nd " ..	9·30 a.m.	2	
22nd " ..	5 30 a.m.	6	
23rd " ...	.....	6	
24th " ..	.....	8	
25th " ...	......	5	

The sheep ate fairly readily throughout and appeared specially to appreciate the berries. From 25th February to 21st March the *Solanum* plants were fed daily to the sheep at the rate of about 5 lb. per day. The plant matured during this period, and towards the end the only parts which would have contained much nourishment were the berries which were ripe. The sheep relished the plant and especially the berries. They maintained their condition on this feed.

2. On 10th February, 1921, two wethers were placed in a separate yard with a good supply of fresh water. After starving the animals for twenty-four hours, 5 lb. of *S. esuriale* was given to them, and this was periodically increased until on 14th February 10 lb. was reached. This proved to be sufficient until 23rd February when the ration was increased to 15 lb. which amount was kept up until 25th February. The sheep did not relish the plant at the commencement, but after the first few days, when they became used to it, they seemed to like it very much. The condition of the sheep did not change a great deal, though as was only natural, one noticed a slight falling away.

3. In order to test the berries alone, two sheep, treated as in No. 1, were fed in February, 1920, with berries by hand as follows:—On the morning of 22nd February fifty berries (2⅓ oz.) were fed to each of the animals. In the evening 100 berries were fed to each animal, which was also given a small drench of water. Water was withheld until 5 p.m. on 23rd February, when 200 berries were fed to each and a drench of 8 oz. of water administered. The fifty berries first fed were mostly ripe and yellow, the others green and about to change colour. The sheep ate them readily when placed in the mouth. No ill effects were observed in any of the sheep.

These experiments would indicate that *Solanum esuriale* cannot be classed as a definitely toxic plant, although it must be admitted that the information supplied by Inspector Johnston suggests that further work should be done on one point, namely, the effect of the plant on very hungry and thirsty stock. Mortality occurring amongst stock coming within this last category, however, is too often held to indicate toxicity in a given plant, whereas the causes of death are often acute indigestion, tympanites, &c.

Under normal conditions *S. esuriale* is a plant of some fodder value, and is quite palatable to stock. The reluctance of the sheep to eat it when first penned is largely the natural result of penning and handling paddock sheep, and will be observed with most plants fed in the same way.

Much assistance was rendered in connection with the experiments by the Manager of Nyngan Experiment Farm, Mr. S. Rudkin, and his stock assistants. No. 2 experiment was carried out by them at our request.

II.—Patterson's Curse (*Echium plantagineum.*)*

E. plantagineum Lin. ; cauline leaves, linear-oblong cordate at the base, calyx much shorter than the corolla-tube, cymes elongate, stamens slightly protruded. *E violaceum*, Brit. Fl. not of L. Cornwall and S.W. of Jersey ; fl. June-Aug. Root fusiform, annual or biennial. Stem 1–3 ft , erect or ascending, diffusely branched. Leaves radical 4–6 in., lanceolate, petioled ; cauline spreading, obtuse, sometimes dilated at the base. Cymes 4–6 in., spreading, curved. Calyx-lobes subulate-lanceolate. Corolla 1 in., dark blue-purple. Nutlets as in *E. Vulgare*. Distribution.—Spain and Mediterranean region to Greece.

For the feeding experiments with Patterson's Curse, the effect of which plant on stock was reported to be the subject of much uncertainty, the district selected was Dubbo. The area selected measured about a quarter of and acre, and was entirely covered with Patterson's Curse, except for a few plants of trefoil, barley grass, and stinging nettle. There was also present some variegated thistle (*Carduus marianus*) but this was all cut out. Water was supplied in an iron trough, being carted thereto from the homestead supply. Shelter was provided by a fine shade tree in the middle of the plot.

Two sheep (3-year old wethers) and two head of cattle (a steer and a heifer, each about 20 months old) were placed in the enclosure on 10th September, the plant being at that time well grown, and just about in time to come into flower. The stock ate the plant readily – in fact, when feed in the area was becoming scarce they appeared to prefer the Patterson's Curse to the few other odd plants, even eating it below the surface of the ground. They did not eat the nettle.

The animals were released on 4th October, thus making the feeding period three weeks and three days, during which the animals were confined to an almost exclusive diet of Patterson's Curse. They improved in condition, especially at first, until within a few days before release, when they commenced to fall back a little. This falling off was due to the fact that the plot was eaten out and badly soiled.

This experiment indicates that it is possible to stock Patterson's Curse very heavily for short periods, that it is a good fodder plant, and that (at all events under circumstances such as those existing at the time of the experiment) it is quite devoid of any poisonous properties.

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* The matter under this heading has been written in collaboration with Mr. F. W. Gavel, Inspector of Stock.

III.—Dogwood Poison Bush (*Myoporum deserti.*)

Myoporum deserti, A. Cunn.; Benth, in Hueg. Enum. 78.

An erect glabrous shrub, nearly resembling the narrow-leaved varieties of *M. acuminatum*, but the leaves still narrower, linear or linear-lanceloate, acute or almost obtuse, entire, rather thick, 1 to 2 inches long, and narrowed into a very short petiole. Pedicels often several together, rather thick, and almost always remarkably re-curved. Calyx and corolla about the size of the smaller-flowered varieties of *M. acuminatum*, but the corolla very regular, without any or with scarcely any hairs in the throat. Stamens five, all equal in every one of the numerous flowers examined, the anthers not exserted. Ovary two-celled, or very rarely three-celled, with one ovule in each cell. Fruit ovoid "yellowish," 2 to 3 lines long, not compressed, usually with two cells and seeds. (A.DC. Prod., xi, 707.) B. Fl. v. p. 3.

In this *Gazette* for January, 1897, Vol. VIII, Maiden states that this appears to be a well authenticated poison bush, but apparently only when in fruit. Gordon and Bailey quote stockowners to the effect that frequent losses from this plant occur amongst travelling stock, and Ewart notes that it is supposed to be poisonous. Recently from the Cobar district it was again reported as causing loss among travelling stock, and as this spring (1921) there was a plentiful supply of the plant round Cobar it was decided to test it by feeding. Inspection of the country over which it was growing showed that there was no evidence of it having been grazed by stock, but good feed was plentiful, so that it would naturally be avoided.

Three sheep (6-tooth Merino wethers in good condition) were penned and starved for thirty-six hours. On the morning of 15th September No. 1 sheep was fed with ¾ lb. of berries, green, but in all stages from those just formed to those commencing to turn yellow. No. 2 sheep was fed at noon with ½ lb. of leaves, and at 2 p.m. with a further ½ lb. The animals showed considerable repugnance to eating the plant. No. 3 sheep was left as a control.

No change of any sort was observed. Decoctions were then made by mashing up 1 lb. berries with sufficient cold water just to cover them, and crushing up 1 lb. of leaves in sufficient cold water to dampen the mass. These were allowed to stand all night, and next morning Sheep No. 1 received 6 oz. of the berry decoction, and No. 2 received 8 oz. of the decoction of leaves. Again no change occurred. On 18th September, the sheep having received no food in the interval, No. 1 was fed 1½ lb of berries, mostly on the young side, and No. 2 received 2 lb. of the leaves. No ill effects were observed.

The sheep received water from the town supply throughout the experiment. The amounts given were strictly weighed as in all the experiments, and none was wasted, the feeding process being naturally tedious, owing to the dislike of the animals to the plant. There was thus no evidence of toxicity as regards sheep even though the animals were very empty, as from the 14th to the 18th of the month all they received was what was fed to them. They were, however, as noted, in strong condition. It was not considered necessary to prolong the feeding as all accounts asserted that the supposed poisonous action was rapid and acute.

Stock Inspector Reuss, of Cobar, gave great assistance in preparing the plant and feeding during this experiment.

Material consisting of leaves and berries was supplied to Mr. Whitehouse, B.V.Sc., who carried out feeding experiments with young pigs, but no evidence of toxicity was shown.

IV.—*Swainsona affinis.*

This particular species of *Swainsona* has not, so far as the writer is aware, been accused of possessing toxic properties, but as at least two other species (*S. luteola* and *S. galegifolia*) have been definitely proved to be poisonous, the opportunity was taken when feeding with other plants to test *S. affinis.*

Two sheep, Merino wethers, in good condition, were penned on 17th February, 1921, and fed for three days on Sudan and other grasses and herbage from the farm and provided with water. These sheep had been recently brought back from agistment in Sydney and were in apparent good health.

A very hot spell was experienced the week before the experiment. The season had been very bad up to January, when rain fell and very rapid growth resulted in the end of January and the early part of February. At the commencement of the experiment the plant was in various stages of flower and fruit and with plentiful foliage.

The experiment commenced on 21st February, and was completed on 12th March. The amounts consumed were: first day, 4½ lb.; second, 10 lb.; third, 7 lb.; fourth, 9 lb.; fifth, 6 lb. From thence to the end the feeding was continued by Stock Assistant Elliott, of Nyngan Experiment Farm, who reported giving the sheep an average of 9 lb. daily. In all, between 26th February and 12th March, the two sheep consumed 135 lb. weight of the plant.

No ill effects of any kind were observed during or after the feeding. The plant was fed immediately after being cut.

MARKETING OF POP CORN.

COMPLAINTS have reached the Department of Agriculture from the manufacturers of pop corn that farmers who have grown this crop are lax in their methods of preparing their product for the market. The chief trouble is that the corn is not allowed to dry sufficiently.

Growers are advised that pop corn for manufacturing purposes must be thoroughly and completely dry, otherwise the popping quality is seriously impaired. The good prices which are ruling for this type of corn are inducing growers to rush their product to the market. No action will tend to deprive farmers of the good prices more than this hasty marketing, for in such condition pop corn has very little manufacturing value.

Other causes of complaint are the presence of or damage by weevil and the presence, owing to improper cleaning, of large quantities of chaff.

H. WENHOLZ, Inspector of Agriculture.

Orchard Experiments.

TRIALS WITH STOCKS AT YANCO EXPERIMENT FARM.

W. J ALLEN and J. M. ARTHUR.

[In publishing the account of these experiments it is pointed out that the series of trials is not yet concluded, and that the following notes therefore constitute a progress report, not final conclusions.]

In the planting season of 1916 stocks of peach, apricot, and Marianna and Myrobalan plum were planted in their permanent positions in this orchard. The stocks were planted alternately in the rows, and in the autumn of 1917 were budded to d'Agen prune. Owing to the fact that prunes are six to nine years old before coming into profit, no definite information can be supplied for some years yet regarding the cropping of this variety on the individual stocks, but the following few points on the growth of the trees may be of interest.

The trees on Marianna and apricot stocks are making slightly better headway than those on Myrobalan and peach stocks. The peach stock is producing trees perhaps equal in size to those on apricot and Marianna stock, but trees that are not furnishing so well with fruiting laterals. Those on Myrobalan stock are comparatively weak.

In addition to the above, approximately 4 acres of similar stocks were planted in 1917 and budded in 1918 to the following varieties:—

Oregon Silver Prune	1 row	21 trees.
Robe de Sergeant Prune	6 rows	126 ,,
Clairac Mammoth Prune	4 rows	84 ,,
Angelina Plum	22 rows	42 ,,
President Plum	1 row	21 ,,

In all circumstances the stocks were planted alternately in the rows and the treatment as to irrigation, cultivation, &c., was uniform throughout. The fruiting quality of the different varieties of prunes will doubtless be discovered to vary, but again some years must elapse before comparisons can be made on this or other headings. The latter statement will also apply, but in a lesser degree, to the plums Angelina and President.

Of the prunes, Robe de Sergeant and Clairac on these stocks, those worked on Marianna and apricot stocks are at present making the best trees. The Myrobalan stock is producing a very weak and small tree. With regard to the peach stock, it was proved previously in experiments conducted in this orchard that neither Robe de Sergeant nor Clairac would take well when worked direct on to peach, so to overcome this difficulty d'Agen was first worked on to the peach and Robe de Sergeant budded on to the resultant growth of d'Agen; owing to the necessity of cutting it back at least twice, this stock has been weakened, but probably in a few seasons it will make equal growth to the other trees.

The prunes, Robe de Sergeant, d'Agen, and other varieties planted in 1908 are all on Myrobalan stocks, and at present it would be difficult to find better grown or more prolific trees in the State, yet for about four seasons after planting the trees made very poor growth, so probably as these younger trees on Myrobalan grow older they will make satisfactory headway.

Of the plums, those worked on Marianna are fruiting heavier at a much younger age than those on the other stocks, and the result is that the trees do not compare in size to those on peach and apricot, while the Myrobalan again is producing weak trees. Probably the peach and apricot stock will settle down in a year or so and produce heavily. At present the trees are very big and strong for their age, and not very productive in comparison to Marianna It is probable that as the trees get older there will be more difference in size between trees on the different stocks than is now apparent. This will be the natural consequence of the trees on Marianna fruiting so heavily when young. Their smaller size is probably a characteristic—possibly a desirable characteristic. Certainly it would tend to convenience and less expense in harvesting and pruning.

ROADSIDE FRUIT CULTURE.

IN Bohemia, says the *Journal* of the Irish Department of Agriculture, all high-roads and by-roads are required by law to be planted with fruit trees—on both sides where the width of the road is sufficient, and on one side in the case of narrow lanes. The young fruit trees must, when planted, be at least 1¼ inches thick in the stem and 6½ feet high, and must be supported by a pole of at least 1¼ inches in diameter. They must be planted on the slope of the roadway at a distance of 8 inches from the edge, or else on the farther side of the ditch. In the former case the trees are planted by the town or parish authorities, who also receive any revenue arising from the plantation In the latter case, the trees are planted by the owners of the field adjoining the road, and these owners enjoy the profits of the sale of the fruit. If a tree dies, a fresh one must be planted to replace it. The crop of one lot of thirty full-grown road-side plum trees is quoted as showing a profit of £103.

Where the road runs through forests or towns, planting of roadside fruit trees is not insisted upon.

The Bohemian small boy is evidently an animal of an uncommon type.

HAWAII FIGHTS FOR NON-TUBERCULAR MILK.

IN the work of tuberculosis eradication a new method of procedure has been adopted in that each and every milk producer must obtain a tuberculin test certificate, showing that his cattle have been tested and that he has cleaned and disinfected his premises. Through co-operation with the City and County Milk Inspector no permit to sell milk will be issued to a producer until he has first obtained the above-mentioned test certificate.—The Territorial Veterinarian, Territory of Hawaii.

Downy Mildew of the Vine.

SOME EXPERIMENTS.

W. le Gay BRERETON, Assistant Fruit Expert, H. G. WHITE, Superintendent, Narara Viticultural Nursery, and C. O. HAMBLIN, B. Sc., B. Sc. (Agr.), Assistant Biologist.

EXPERIMENTS for the control of "downy mildew" of the vine (*Plasmopara viticola*) have been in progress for some years at Narara Viticultural Nursery. From time to time suggestions have been put forward for the control of the disease by various proprietary preparations, either in the form of sprays or dusting powders. Some of these powders are brought into suspension in water and applied as sprays; other preparations are offered for sale as pastes, and are brought into suspension in water and then applied as sprays.

From the nature of the organism causing "downy mildew," it is clear that any fungicide which is to give effective control must:—

1. Protect the leaves against the germination of the zoospore by providing a protective layer.
2. Remain adhering to the leaves for a considerable time and not be washed off by rain.

The zoospore is the tiny swimming organism which is released from the "downy mildew" spore. After a short life swimming in drops of water it finally settles down on the leaf, gives rise to a germ tube, and penetrates the tissues.

The bulk of the preparations which have promised to meet these two requirements are copper fungicides.

The First Season's Experiments at Narara.

In 1920, thirty-nine rows of young Muscat Hamburgh vines in the Narara Nursery were allotted for a test with a proprietary powder described as "Bordeaux mixture powder." The powder was tried dry, suspended in water, and suspended in water with the addition of lime. During the earlier part of the growing season all the vines had received several applications of the home-made 6–4–40 Bordeaux mixture. The experiment in that year was, therefore, only a test of control by the powder on the young growth, as experience had shown that ordinary Bordeaux mixture (home-made) remains on the sprayed leaves of the vines for long periods.

On 20th February sprays Nos. 4 and 5 were discarded, as it was found that "downy mildew" was not being checked by the application of the "Bordeaux mixture powder" in the dry form; in fact, the upper portions of the vines had lost a proportion of their leaves, which was good evidence that the pure powder and the powder with 50 per cent. lime were not effective. The tests, in the case of the application in the dry form were given a trial of some thirty-seven days.

With regard to sprays Nos. 2 and 3 there was practically no difference between the control given by them and the No. 1, so that it appeared that the smaller quantity of powder was as efficient as the larger quantity.

The following plan was made of the vines treated :—

No. of rows treated.	Spray material and strength.	Spray No.	Date sprayed, 1921.				
			Jan.	Feb.	Feb.	Feb.	Mar.
5	Bordeaux 6-4-40	1	15	2	16	...	19
7	Bordeaux mixture powder, 6 lb.; water, 50 gallons...	2	15	2	16	...	19
3	Bordeaux 6-4-40	1	15	2	16	...	19
6	Bordeaux mixture powder, 4¾ lb.; water, 50 gallons..	3	15	2	16	...	19
3	Bordeaux, 6-4-40	1	15	2	16	...	19
6	Bordeaux mixture powder (pure) ...	4	15	2	16	21	*19
3	Bordeaux 6-4-40	1	15	2	16	..	19
6	Bordeaux mixture powder and 50 per cent. lime	5	15	2	16	21	*19

* On 21st February and 19th March Nos. 4 and 5 were treated with spray No. 1.

The following rainfall was recorded in connection with the trials :—

1919.	Points.	1920.	Points.
July	237	January	610
August .	55	February	265
September ...	328	March	103
October . .	318		
November	394		
December	201	Plus 6 months, 1919	1,533
Total ...	1,533	Total for period	2,611

Rainfall during actual period of spraying test, 8 06 inches.

From this experiment it was concluded that in the dry form the powder was useless, and there was practically no difference in the result between the ordinary Bordeaux mixture and the spraying mixture made from the powders. The powders mixed at both strengths were equally good and effective in checking "downy mildew." No difficulty was experienced in mixing; settlement was about the same as with home-made Bordeaux mixture, and the spreading and adhesive qualities at and after application were good. It was much lighter in appearance than 6–4 40 Bordeaux. It was decided to test this powder again in 1921.

The Second Season's Experiments.

The disease made its first appearance on 27th November, 1920, but did not appear in an epidemic form until January, 1921.

The experiments attempted during the seasons 1920-21 included not only Bordeaux mixture powders from two sources (local and imported) but a "Bordeaux mixture paste" as well. Twenty rows of young Musca Hamburgh vines were selected for the tests, which compared Bordeaux mixture 6-4-40 (home-made) with the proprietary preparations.

Two rows each of the above-mentioned vines were alloted to each test:

No. 1. Bordeaux mixture (home-made) 6-4-40 (*check*).
No. 2. Bordeaux mixture powder (imported) 4 lb. powder, 50 gallons of water.
No. 3. Bordeaux mixture powder (imported) 4¾ lb. powder, 50 gallons of water.
No. 4. Bordeaux mixture 6-4-40 (*check*).
No 5. Bordeaux paste (imported) 9 lb. paste to 50 gallons water.
No. 6. Bordeaux paste (imported) 11 lb. paste to 50 gallons water.
No. 7. Bordeaux mixture 6-4-40 (*check*).
No. 8. Another Bordeaux powder (local) ½ lb. to 8 gallons water.
No. 9. Another Bordeaux powder (local) 1 lb. to 8 gallons water.
No. 11. Bordeaux mixture 6-4-40 after appearance of "downy mildew."

Control row (No. 11) was left to be unsprayed until the disease appeared.

Sprays No. 1, 2, 3, 5, 6, 8 and 9 were applied on 2nd and 16th December, 1920, 10th and 31st January, and 18th February, 1921. Between the 2nd and 16th December the vines were covered with flood water three times, and the spraying of the 10th January was preceded by six days of heavy rain.

Spray No. 11 was applied on 10th January, 1921, after "downy mildew" had appeared, and these vines were again sprayed on 31st January and 17th February.

Cost of 10 gallons of material including mixing and applying.—

No. 1.—2s. 2d.
No. 2.—2s. 5½d.
No. 3.—2s. 8d.
No. 5.—3s. 8d.
No. 6.—4s. 2d.
No. 8.—2s. 1d
No. 9.—2s. 11d.

The following was the rainfall during the period under review:—

1920.	Points.	1921	Points.
July	527	January	719
August	148	February	82
September	86	March	511
October	111		
November	322		
December	1,642		

The weather conditions on the days of spraying were:—

1920
December 2—Dull and Cloudy.
December 16—Mild.

1921
January 10—Warm
January 31 Dull.
February 18—Warm.

Summary.

The results of this experiment may be briefly summarised thus:—

1. Great control of the disease was obtained with home-made Bordeaux; the leaves coated by the spray were entirely free from disease

2. The Bordeaux mixture adhered remarkably well, and was not removed by rain. Forty days after the last application the spray was still adhering to the leaves, and practically no disease was observable.

3. The imported powder did not adhere so well, gave fair control of the disease, but was inferior to home-made Bordeaux. The period of protection was shorter, and the mixture more easily removed by rain. The smaller quantity of the powder was as effective as the larger.

4. The imported paste was somewhat less effective than the powder. Many of the vines dropped a portion of their foliage, and the appearance of the vines compared unfavourably with those in the checks and blocks Nos. 2 and 3.

5. The other Bordeaux powder (local) was inferior to the preceding sprays, and gave ineffective control. It was also readily washed off, the vines were almost denuded of foliage, the mixture was difficult to keep in suspension, and even with rapid and continual agitation only a small quantity adhered to the under-surface of the leaves. It is of no value, and its use is not recommended to any growers for the control of downy mildew.

6. The young grafted vines left as controls were unsprayed until the disease first appeared, and they were then sprayed with home-made Bordeaux. The later foliage was disease-free. The leaves attacked in the early stages did not recover.

Conclusion.—The above facts indicate the value of a protective coating of home-made Bordeaux, and are a further proof of the importance of the injunction that spraying before the disease makes its appearance in a disease-liable area is a sound policy. "Prevention is better than cure."

A remarkable feature of home-made Bordeaux (6—4—40) applications in *other* parts of the nursery this season was the manner in which the *early* applications continued to protect the coated leaves against "downy mildew," but such results depend on the great care taken in preparing it, and on the use of good lime.

Sulphuric Acid Sprays.

These sprays were suggested for trial. The inclusion of acid in the experiment seemed unlikely to give control, owing to its lack of permanency. The sprays were applied at a strength of 1 to 2,000 on 1st and 18th December, 1920, and were found not to be effective. They were discontinued on 24th December.

Other commercial specifics have been tried at Narara this year—1922—but so far no spray superior to Bordeaux mixture has been obtained.

Experiments at Yanco.

Consistent results with Bordeaux mixture have also been secured under the very different conditions of the irrigation area at Yanco. In this connection the report of Mr. J. M. Arthur, orchardist at Yanco Experiment Farm, on experiments carried out under his control in 1920–21 is interesting.

"*Summer Spraying.*—'Black spot' was first detected on 25th September and 'downy mildew' on the 6th November. Spraying was carried out on the following dates, from two to three days being taken to complete the spraying in each instance :—

26th September.
9th October—Bordeaux mixture, 6-4-50.
19th October.
4th November.
11th November.
15th November.
18th November.
3rd December.
13th December—Burgundy mixture, 4-6-50.
22nd December.

"From the end of December onwards, warm to very hot weather was prevalent, and the conditions therefore were not favourable to the development of the diseases. With regard to Burgundy versus Bordeaux mixture for the control of 'black spot,' the former mixture was not so successful as Bordeaux in controlling this disease, but guve equal and excellent results in keeping 'downy mildew' in check.

"The rainfall for the period, 26th September to 22nd December, was as follows :

25th September	5 points.	2nd November	12 points.
6th October	14 ,,	16th November	97 ,,
7th October	69 ,,	30th November	22 ,,
11th October	14 ,,	5th December	3 ,,
23rd October	24 ,,	9th December	57 ,,
24th October	49 ,,	10th December	47 ,,

"Although a very light crop of sultanas and a moderate crop of currants were harvested, the loss can be attributed to the nature of the soil, which remains wet and sloppy on the surface, thus preventing the spray equipment from being taken on to the blocks for some days after the rain. Where it is possible to spray within a short period after rain, I have no hesitation in saying that it is possible to save a greater percentage of the grape crops from loss by black spot, and practically all, or a greater percentage, from loss by downy mildew. I would suggest, wherever possible, to recommend the use of Bordeaux in preference to the Burgundy mixture, as the two diseases black spot and downy mildew develop under somewhat similar climatic conditions, and Bordeaux gave best results in checking the combined diseases."

Departmental Recommendations.

At present the Department makes the following recommendations for the spraying of vines affected with downy mildew :—

In the control of this fungus Bordeaux mixture is most effective, and an endeavour should be made to keep continuously a coating of the fungicide upon the vine to prevent infection taking place.

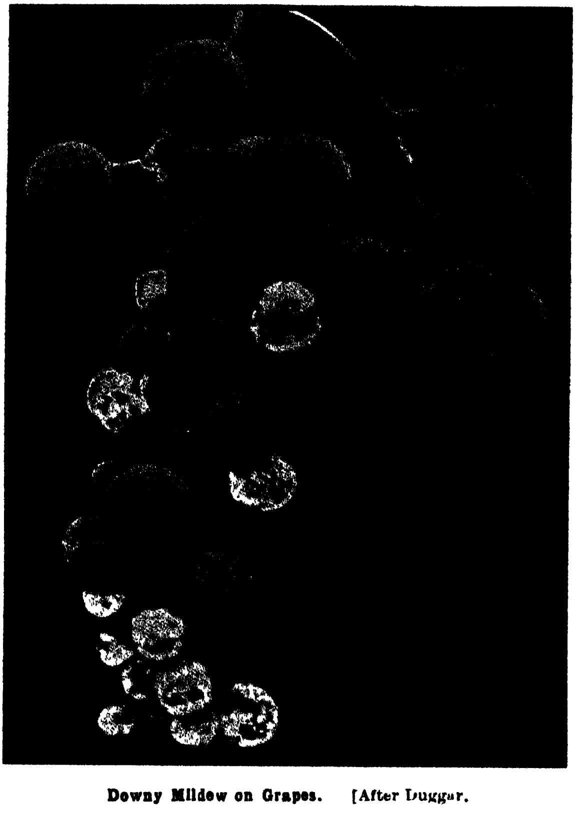
The principal formula for Bordeaux mixture is as follows :—

Bluestone (copper sulphate)	6 lb.
Lime (freshly burnt)	4 lb.
Water	40 gals or 50 gals.

It should be emphasised that Bordeaux mixture must be applied *before* the disease makes its appearance in order to ensure adequate protection. No hard-and-fast rule as to the time of spraying can be laid down. The outbreak of downy mildew is largely dependent upon prevailing weather conditions. In districts liable to black spot, the spray (Bordeaux 6—4—40), given when the early buds are bursting, will also protect the vines for a short period against a very early attack of downy mildew. If the grower finds it unnecessary to take measures against black spot he should apply his first spray for downy mildew (Bordeaux mixture at 6-4—50 strength) when the shoots are about 9 inches long—not later. As new growth appears the vines should be resprayed—roughly at intervals of about two weeks.

Generally speaking, downy mildew attacks vines later in the season than black spot, chiefly when the fruit is set. In some vineyards as many as six applications of spray are made. It is important that the Bordeaux should be freshly made when applied.

In abnormally bad seasons Bordeaux mixture, made to a strength of 10-5-50, may prove an advantage.



Downy Mildew on Grapes. [After Duggar.

In districts where good lime is hard to procure, washing soda can be substituted and Burgundy mixture made instead of Bordeaux. This spray is made according to the following formula:—

Bluestone	4 lb.
Common washing soda	6 lb.
Water	50 gallons.

It should be carefully made as recommended in the Department's Farmers' Bulletin, No. 72, "Spraying." It is important that it be applied *fresh*.

Spray pumps are procurable for handling very small or very large areas and vary in design from hand machines to power and horse tractor types. A type should be chosen which will enable the grower thoroughly to coat the whole of the leaves of the vines with the spray.

Horticulture.

E. N. WARD, Superintendent, Botanic Gardens.

HORTICULTURE, like agriculture, has its history and epochs. The name "horticulture" was derived from the old Roman idea that a garden was an enclosure apart from agriculture, which concerned the tending of the fields or those parts beyond the enclosed or protected area. It is divided into four branches—(1) landscape, the art of designing a garden or park, and the growing of plants for use in landscape gardening; (2) floriculture, the raising and growing of flowers for ornamental or commercial purposes; (3) pomology, the growing of fruits; and (4) olericulture, or vegetable gardening.

In the world at large, landscape gardening is by far the most important if measured by its value to posterity and by the amount of training necessary; floriculture, if calculated by the number of people interested, the number of species and varieties of plants grown, and the money spent; pomology, if calculated by commercial interests and capital invested; olericulture, if calculated as supplying the universal needs of mankind. In some countries, such as France, olericulture is practised mainly by gardeners, in others it is left to farmers, while in this State it is largely in the hands of aliens.

In making your own garden it will be found wisest to thoroughly dig or trench the whole area before making the paths, if the time can be found and you are willing to do the hard work of trenching. Do not bring the lower soil to the top; break it up, but leave it where nature placed it, whatever it might be, and while it is exposed and get-at-able be generous with some good bonedust. If it is good it will lie there for years, and roses, flowering shrubs, and, in fact, almost anything, will be encouraged to root away down from surface climatic conditions—from the hot surface in summer—and if the soil be well aerated by natural or artificial drainage, away also from the cold surface in winter. By working the whole area, a greater freedom for drainage, and thereby root action, is provided, for the subsoil once broken up never becomes hard again, even if the surface is used as a path.

Make the paths simple, with one graceful curve, not two; double curves are bad and look like dogs' hind legs; besides, life is too short to go round too many angles and corners. Let the edges of the paths be simple; nothing looks better than grass verges, but these mean work, and possibly to a cottage gardener needless work, but nothing looks more ugly than an edging of bricks with the sharp edges standing up, and nothing makes a mother more fearful than to see a little tot toddling down such a path; an edging of rosemary, lavender, parsley, and many other plants could be used with much better effect.

The Importance of Thorough Cultivation.

It is no use talking about what to grow until the storehouse, *i.e.*, the soil, is properly prepared to receive it. If the storehouse of fertility is not clean and well ventilated by good trenching and drainage, if the ground, that is, is hard, unworked, and wet, no good and prolonged results can be obtained.

Soil is a mixture of mineral products and animal and vegetable remains that have formed and collected for ages, always decaying and changing. It is divided into two divisions, inorganic and organic. Inorganic is composed of crumbling rocks, chiefly silica. Organic is composed of something that had grown, such as fallen leaves, decaying vegetation, &c., and it is the proper mixing of these two (inorganic and organic) in just their right proportions, for this plant or that tree, which makes a good soil, the one giving bone and the other flesh, as it were. A good typical soil for all purposes is midway between sand and clay. Sand is no good; sandy loam, not bad, easily worked, but very hungry; loam, just right, and if properly worked will grow anything and everything; clayey loam, not bad, but hard to work and needs a lot of working; clay, no good. But whatever the soil may be, dig deep (trenching is better), and be sure if the ground is wet that the water gets away by filtration through draining—either natural or artificial—and not by evaporation, for then the sun is not warming the ground, but constantly keeping it cold and sour by sealing up the pores of the soil against the free circulation of warm air which is so necessary to good healthy growth. So, to use manures rightly, with economy and efficiency, one must have a knowledge of the soil as a compound substance that must be kept constantly charged with the proper quantity of plant-food in such a form as can readily be taken up by the vegetation held by it.

The Question of Manuring.

When the garden is properly made, it must not be thought that because it is new manure will not be required. Virgin soils are sometimes the most sterile until cultivated. A chemical analysis may show that a soil is very rich in some element absolutely necessary to plant life, but it may lie in the soil in an insoluble state, waiting for the same element in another form (through the medium of decayed vegetation) and for micro-organisms to set it free. The safest plan in a new garden is to feed liberally while the ground is clear and there are no roots to worry about, and the safest and best food is farmyard manure, or stable manure as a substitute. This manure contains all the elements essential to plant growth. A liberal dressing of farmyard or stable dung would be three or four good barrow-loads to twenty-four square yards. There is the opportunity of getting it in now, while later on the permanent plants will interfere with such liberal applications. Later on, when planting what is called permanent stuff, such as fruit trees, flowering shrubs, and roses, a good sprinkling of bonemeal in the bottom of your trench or hole is strongly recommended. This form of manure is not quick in its action, and the plants will get benefit from such an application for years. This applies to new ground where the gardener is to a certain extent working in the dark, not knowing for a time what food is best suited to the soil, but experience and observation will soon indicate what the plants are really asking for and what the soil is short of.

As regards old cultivated ground, matters may be different. There may be sufficient humus in the soil and sufficient soluble elements only waiting for the cultivator to let in the proper amount of air and water, but if after an attempt at cultivation a lack of quality and quantity is found in the products, it will be a question what is the food the plants are asking for. The recommendation is again farmyard manure or stable manure, as the safest and best; they are well balanced in essential plant-foods, and if the fault does really lie in the shortage of any one of those foods, this kind of manure is bound to hit it. Should this treatment not alter the production, there is surely another cause, and that cause (it being old garden soil) may be an excess of humus, or clogged or pent up manure, causing too much organic acid in the soil. It is necessary to sweeten such soil. This may be done with lime, but if the liming is not done in the right way it is almost useless; the only benefit derived then would be the addition of a little more food to the soil, for lime is a food in itself. The correct way to sweeten it is to get lime from the kiln in lumps like builders use; the quantity required is half a bushel to twenty-four square yards. Put this in small heaps on the ground to be dealt with; cover the heaps with a few inches of soil until it is slacked; then spread it and get it buried at once, but not deeply. Never use soot and lime together, as some do in this sweetening process. The ammonia in the soot has an affinity for the good properties in the lime, just like the ammonia in the atmosphere has for it if it is left too long on the surface before spreading, and it is these good properties in fresh, newly-slacked lime that have to do the work of sweetening the soil, and they must not be absorbed or taken up by other elements. The effect of this work, if done at the right time of the year, will be very noticeable.

Having thus made the garden and seen to its fertility, the time has come to decide what is to be grown in it—flowers for pleasure or for profit, or both, or fruit, or vegetables.

Floriculture during the last quarter of a century has made wonderful progress, the outcome of a great and ever-increasing love of nature and nature's products among all classes. Thousands are finding that the cultivation of a garden, however small, is one of the best and cheapest hobbies (or luxuries, if you like) in which they can indulge.

One cannot over-estimate the good effects of gardening upon the brain-workers of a nation, while the pleasure is shared by every member of the family. Public parks and gardens have undoubtedly a great influence on floriculture, creating a love of gardening and stimulating a desire for flowers in and around the suburban home.

The ideal garden is one that gives pleasure all the year round, with its midsummer and midwinter flowers as well as its wealth of spring flowers and autumn colour; a garden with its own little plant communities, not all mixed up together until the whole garden is full of mixtures, but a patch of one kind of plant here and another there, with breaks between to lend a feeling of surprise.

Flower Growing for Profit.

Some may desire to grow flowers for profit, or at least to combine the hobby with profit. In this case it is better to devote oneself to some speciality, for specialities pay far better than general mixtures. It is necessary to decide first whether the soil, aspect, and climate will suit the line preferred. If in doubt and if there is no local example to guide you, ask some expert, and if the evidence is adverse turn the idea down, for profits are not made out of experiments or fancies. Take up something else which the market is always ready for, and of which your district shows examples of successful culture. Send the best to market; if they are good they will find ready sale, and providing a high standard of culture and a tidy way of packing is maintained, it is astonishing how soon the buyer will come to you.

One of the best paying specialities is well-grown, long-stemmed carnations in winter time, in pink, scarlet, and white. The grower who can provide these will have no difficulty in growing them at other times of the year, and certainly no difficulty in disposing of good bloom. Do not touch mixed colours; stick to two good winter self-flowerers and the best white the district will grow. Grow them in quantity, but never more than can be turned out with the hall-mark of quality; it is a reputation that is aimed at in the first instance. In carnation-growing there will be many disappointments and failures, but it will be from these that the most valued experience will be gained.

Any district in New South Wales should grow excellent Iceland poppies, and if near the market there should be no difficulty in competing with the large trade Melbourne has with Sydney in this popular and delightful decorative flower.

The kinds most easily produced should have the smallest place; there will be a readier sale for lines most difficult to grow.

Fruit and Vegetable Growing.

Pomology, or fruit-growing, is one of the most fascinating yet fickle hobbies or industries in which one can indulge. Much has been written and done in New South Wales in connection with it as a branch of agriculture, but the subject is intensely horticultural, and one which should have the brightest light of horticultural research to guide it. No branch demands more careful guiding than does that of fruit-growing; yet it will be admitted that no branch of horticulture has been given more excellent attention in this community.

Measured by supply and demand vegetable-growing is a fluctuating industry, not only in production but also in labour, consequently it is a very precarious occupation, chiefly owing to the lack of opportunities for training men in this important branch of gardening. Owing to the trade being chiefly in the hands of aliens there are no training grounds for our young men, and so fickle are the markets for this produce that anyone launching into the vegetable-growing industry soon begins, like Goethe, to cry out for more light. No branch of horticulture requires more light and guidance. Country branches of the Agricultural Bureau are doing good work, but for these branches to be fed spasmodically with an occasional lecture on the generalities of the subject is not sufficient. The Technical Education Committee of the Surrey (Eng.) County Council have a series of ten lectures for rural and semi-rural districts given by the best lecturers possible, and all ending with the subjects of encouragement and endeavour and the high ideals of gardening.

Every occupation in life has its impediments, and this law of opposition certainly pervades our gardens. The worst enemies we have to contend with, I think, are weeds. They rob the host of its food and moisture in a shameful way. Insect pests are the next troublesome, but if the golden rule of a stitch in time is practised a garden can be kept clean. Good cultivation and a garden clear of weeds is an excellent remedy, never forgetting that in the case of pests prevention is far better and easier than cure. Scale insects are bad if allowed to get too far, but the worst are easily killed if the killing is done just when the old scales die and the youngsters are beginning to shift for themselves. A weak solution of caustic soda will kill at this stage, but it takes stronger and more expensive methods if the scale gets full grown.

Outbreaks of fungus pests are often the result of wet or humid atmospheric conditions, but if detected in time a spraying with Bordeaux mixture will keep this also well in check.

THE KEEPING QUALITIES OF STRAWBERRIES.

THE length of time that the strawberry will stand up after it has been picked depends upon the variety, the degree of ripeness, the care with which it is handled, and the temperature of the berries at the time they are picked and at which they are held after picking. Experiments have shown that for each rise in temperature of about 15 deg. Fah. the life of the berry, other things being equal, is decreased one-half, that is, if the strawberry will keep for eight days in good condition at a temperature of 40 deg. Fah., it will keep for only four days at a temperature of 55 deg., only two days at a temperature of 70 deg., and only one day at a temperature of 85 deg. If the berries are picked in the early morning when they are relatively cool, and put at once in the shade, they will keep much better and have a much better appearance on the market than if picked at midday when the berries are warmer, or if left in the sun after picking.—*Farmers' Bulletin*, 1028, United States Department of Agriculture.

Leaf Galls of Phylloxera at Howlong.

W. W. FROGGATT, F.L.S., Government Entomologist.

AMONG the many remarkable developments in the life cycle of the "vine louse" (*Phylloxera vastatrix*), there are two well defined forms: the aerial aphids which produce curious blisters or galls on the tissue of the leaves, and the terrestrial aphids which feed upon the roots.

The latter are well known, but they do not always form galls upon the roots; only those aphids do so that attach themselves to the fine fibrous roots growing from the stem just beneath the soil. These cause the fine rootlets to swell out into small fleshy nodules, embedded in which the aphids feed and develop. A large number of those infesting the roots, however, do not form galls; but, working their way along the main roots, and puncturing the surface, they cause the roots to become cracked and corroded. It is along the cracks that the tiny yellow aphids take up their residence and finally cause the destruction of the vine.

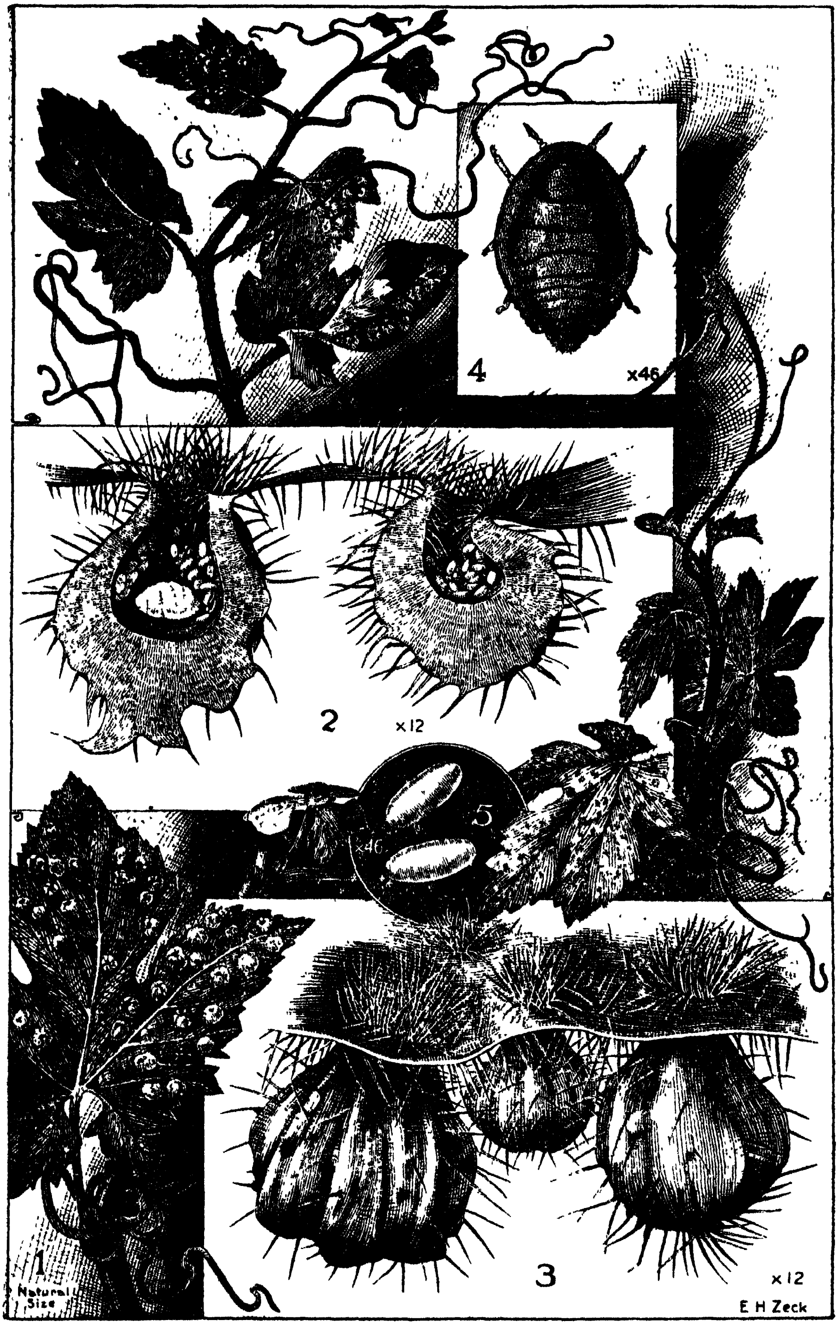
The former, known as "gallicole" insects, are hatched from the winter eggs and are very prolific. They puncture the under-surface of the foliage of the infested vine and produce the leaf galls. This gallicole form is peculiar to the foliage of the different species of American vines, and has never been found (except in rare cases) upon the foliage of *Vitis vinifera.*

When the manager's cottage was built at the Viticultural Nursery at Howlong many years ago a large-leaved American vine (*Riparia cordifolea, Rupestris*) was planted to form a shelter over the front of the house. After all these years it has now developed leaf galls, and Mr. H. L. Manuel, Viticultural Expert, who first noticed it and sent me specimens, informs me that the whole of the foliage is covered with these galls, as illustrated in the accompanying drawing.

Each of these blister galls contains a gallicole aphis, surrounded with her eggs or larvæ, closely packed in the cavity. Later on the active larvæ emerge and make their way down to the roots. This is the first record, as far as I know, of the leaf galls of *Phylloxera vastatrix* having been found in New South Wales, and it is therefore worthy of record.

Melilotus alba AS A GREEN MANURING CROP.

THE utility of Bokhara or Sweet Clover (*Melilotus alba*) as a green manuring crop, compared with grey field peas was tested at Hawkesbury Agricultural College last season, but the result was emphatically in favour of the latter. The clover, it was estimated, yielded 3 tons per acre of green stuff for ploughing under, whereas the yield of field peas was estimated at ten tons. Hexham Scent (*Melilotus Indica*) was also tried, but the seed did not germinate.



Leaf Galls caused by the Vine Louse (*Phylloxera vastatrix*).

1. Leaf, showing galls. 2. Cross section of galls showing female, eggs, larvæ.
3. External appearance of galls. 4. Wingless female of *Phylloxera vastatrix*.
5. Eggs of *P. vastatrix*, magnified.

THE FOOD VALUE OF EGGS.

THE future prosperity of the poultry industry is dependent very largely upon an increased consumption of eggs and poultry The consumption may be increased in two ways :—First, by improving the quality of the eggs that are put on the market. More eggs are naturally eaten when they are fresh. The consumption would be enormously increased if consumers could always depend upon securing good, fresh, wholesome eggs, and any agency that will promote this end should receive the encouragement of poultry-breeders everywhere. If, on the other hand, consumers had a better understanding of the real value of eggs, the consumption would be very much greater.

It seems from recent scientific investigation that the egg has only one real competitor in the world among the essential foods for human beings, and that is milk. The lowly cow and the humble hen carry the burden of the world, so far as it relates to the physical well-being of races. . . . . Human beings have been under the delusion that they were well fed because their diet contained a sufficient amount of protein, with proper heat value. Food values have hitherto been based on heat units or calories, to the disadvantage of eggs. The newer knowledge of the science of nutrition has given the egg an importance in diet that was never known before. With the backing of scientific research, the poultry interests may now organise a movement in the interest of the general welfare, as well as of the poultry industry, to make known to the world the real value of their product. It is safe to say that no food product receives less advertising than the egg. Newspapers, magazines, tram cars, and hoardings, are all used to increase the popularity and sales of various food products. Huge sums are spent in advertising a brand of chewing gum, or chocolates, soaps, tooth paste, a raisin, or a prune, but never a dollar to advertise the best and most nutritious food—with the possible exception of milk—ever given to man.

Moreover, the egg is sometimes discounted by advertisers of other food products, and some of it is misleading, A baking powder company which recently distributed pamphlets throughout the United States, gave fifty-five recipes for doing without eggs without a loss of food value, the substitute being their own baking powder.

Poultry organisations might well take account of such advertising, not only for the sake of the industry, but in the interest of the public, which should be made to understand that there is no real substitute for eggs, and that such advertising is a blow at the health of the people.—Professor DRYDEN, of Oregon Agricultural College.

MILK A CHEAP FOOD.

POUND for pound, milk has more material that the body can readily use than have most common foods. Milk makes more easily available in the body such foods as cereals, potatoes, and bread. Milk is a food for the whole family; no special dishes need be prepared for the younger members of the group if milk is used liberally in cooking, for both older and younger members will have the right food. Milk is ready to use; there is no time and expense of preparation. Last of all, milk, compared with other foods in cost of production, kind of labour required to produce, capital, and investment for production, is cheap.—A. J. GLOVER, President Wisconsin (U.S.) Dairy Council.

Egg-laying Tests at Hawkesbury Agricultural College.

(Under the Supervision of James Hadlington, Poultry Expert.)

TWENTIETH YEAR'S RESULTS, 1921-22.

F. H. HARVEY, Organising Secretary.

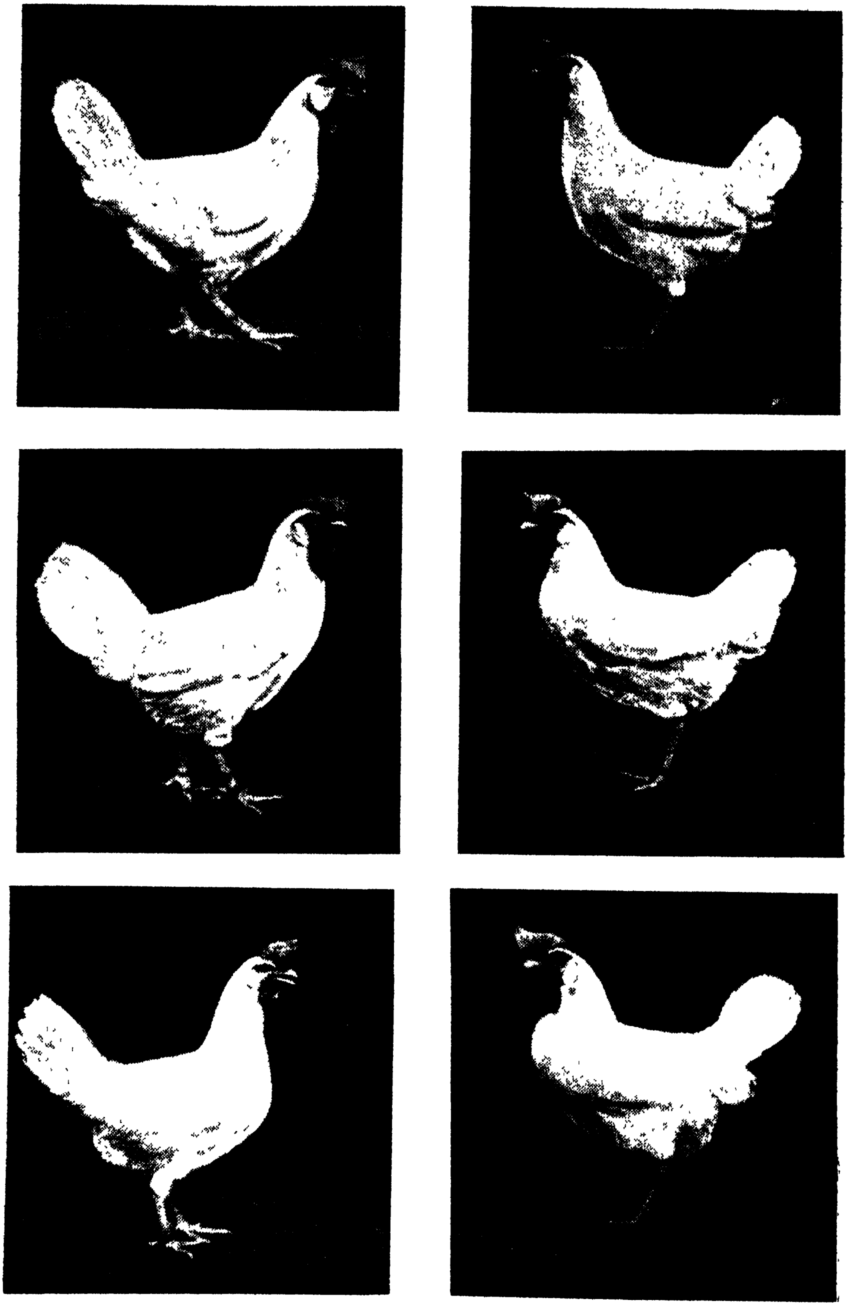
THE Twentieth Egg-laying Competition at Hawkesbury Agricultural College concluded on 31st March, and the record of the results is now presented. The competition was controlled by a committee of management, comprising four officers of the Department of Agriculture and three competitors' representatives, namely, the College Principal (Mr. E. A Southee), Messrs. James Hadlington (Poultry Expert, Department of Agriculture), C. Lawrence (Poultry Instructor, Hawkesbury Agricultural College), A. E. Brown, C. Judson, and E. T. Rhodes (competitors' representatives), and F. H. Harvey (Department of Agriculture), Organising Secretary.

Scope of the Competition.

The competition embraced four sections, namely, open sections for light and heavy breeds, and standard sections for light and heavy breeds. This marks the third year in which competitions were provided for standard-bred birds, the qualification for entry in these sections being that the owner had won a first, second, or third prize with the particular breed entered in an "open show class" at an approved exhibition held in New South Wales during the previous three years.

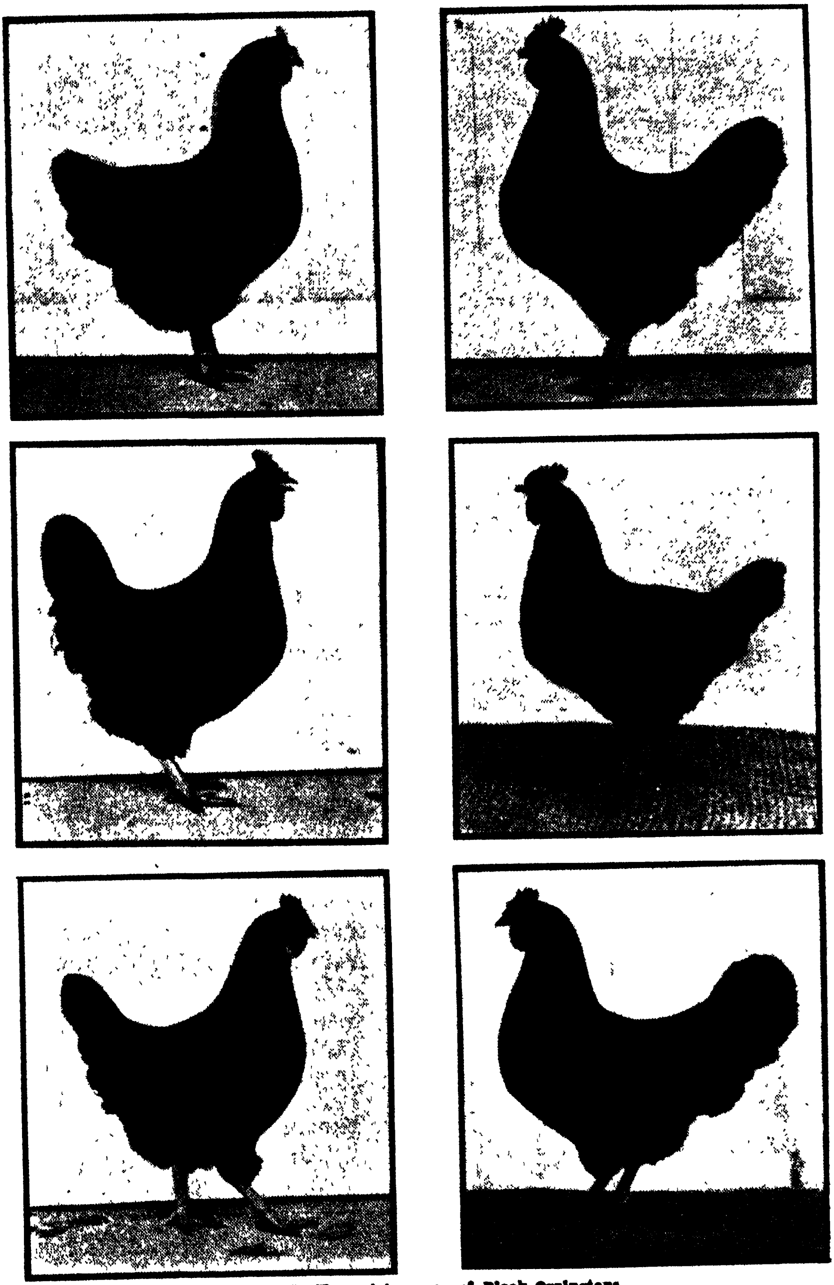
The competitions were limited to pullets between seven and twelve months' old on 1st April, 1921, and pens were allotted as follow :—

	Groups.	Birds.
Section A.		
Open Light Breeds :—		
White Leghorns ...	44	264
Minorcas	1	6
Section B.		
Open Heavy Breeds :—		
Black Orpingtons .	25	150
Langshans	7	42
Silver Wyandottes ...	2	12
Plymouth Rocks ...	1	6
Section C1.		
Standard Light Breeds :—	2	12
White Leghorns ...	1	6
Minorcas	1	6
Anconas	1	6
Black Hamburghs ..		
Section C2		
Standard Heavy Breeds :—		
Langshans	2	12
Rhode Island Reds ...	1	6
Silver Wyandottes ...	1	6
Black Orpingtons ...	1	6
Total	90	540



Mr. L. Graham's group of White Leghorns.

Greatest number of eggs in Twentieth Annual Competition (1,480 eggs) in the whole competition.



Mr. A. R. Kennedy's group of Black Orpingtons.

Greatest number of eggs in Twentieth Annual Competition (1,457 eggs) in Heavy Breeds Section.

A—This hen (No. 59) laid 290 eggs, securing second prize for number of eggs laid by an individual hen in the section.

Weight of Eggs.

The regulation that individual hens must lay eggs of at least 2 oz. each, and that eggs from groups must average at least 24 oz. per dozen within six months of the commencement of the competition, in order to be eligible for prizes, resulted in the disqualification of nineteen individual hens, as follows:—

Disqualified from Individual Prizes.

Light Breeds.—F. A. Bailey (No. 236); L. Graham (No. 344); C. Leach (No. 374); F. S. Longley (No. 388); H. S. Morris (No. 404); A. Ussher (No. 412); Mrs. C. Lewis (Nos. 470 and 472).

Heavy Breeds.—C. Faulkner (No. 9); A. S. Green (No. 29); C. H. Gerrard (No. 32); E. Maher (No. 149); T. McDonald (No. 75); F. Rivers (No. 182); W. T. Sinclair (No. 41); C. Watts (No. 121); H. R. Woolf (Nos. 187, 188, and 192).

Ration fed to the Competition Birds.

The birds were fed on a simple ration, which is best expressed as follows:—

The Morning Mash.		The Evening Ration of Grain.
Pollard	60 per cent.	Two-thirds wheat.
Bran	20 ,,	One-third crushed maize.
Lucerne dust*	15 ,,	
M.I.B. meat meal	5 ,,	

Common salt was added at the rate of 4½ oz. to each 20 lb. (or bushel) of mash.

* When unobtainable its equivalent in bran was used.

The nutritive ratio of the above feed for the day is approximately 1 to 4·5.

Mixing Mash for Adult Birds.—The proportion by weight of bran or bran and lucerne dust is added to the meat meal; then there is poured over it sufficient liquid into which has been dissolved a quantity of common salt equal to 4½ oz. for each 20 lb. of food to be mixed. The bran then resembles a wet mash in the form usually given to horses or cattle; the proportion by weight of pollard is then mixed thoroughly into a mash of a consistency that can be balled by the hands under slight pressure, and will fall to pieces when thrown down. Should the pollard be of a coarse description, less bran is used. On the other hand, should it be fine, more bran is used. The nutritive value of both is so nearly identical that, from that point of view, the proportions are immaterial.

As much chaffed green lucerne as the birds will eat is given at midday. The shell grit supplied consists of two-thirds sea-shell to one-third crushed oyster shell. This is, of course, always available to the birds.

Mortality and Disease.

The mortality for the year was somewhat higher than in the preceding year, being thirty-one, as compared with twenty-four. The details were:—

	1920-21.		1921-22.	
	Light Breeds.	Heavy Breeds.	Light Breeds.	Heavy Breeds.
Birds replaced	1	4	3	5
Birds not replaced	8	11	7	16

Weights of Winning Birds.

The weights of the winning pens at the beginning and end of the competition should be of interest. They were:—

		Weight at April, 1921.		Weight at March, 1922.	
		lb.	oz.	lb.	oz.
Individual Hens.					
Light Breeds—					
F. S. Longley's White Leghorn, No. 385 ..		4	0	4	0
Heavy Breeds—					
W. M. Mulliner's Black Orpington, No. 525..		5	6	6	2
Groups.					
Light Breeds—	343	3	8	4	2
L. Graham's White Leghorns, Nos. ...	344	3	8	3	12
	345	3	8	4	2
	346	3	8	3	14
	347	3	8	4	2
	348	3	8	4	2
Heavy Breeds—	55	5	0	6	4
A. R. Kennedy's Black Orpingtons, Nos.	56	5	0	6	0
	57	5	6	6	8
	58	5	2	5	8
	59	5	2	5	3
	60	5	0	5	3

Scores of Leading Birds.

The following table shows the monthly records of the ten leading birds in light and heavy breeds.

Owner and Breed	April.	May.	June.	July.	August.	September.	October.	November.	December.	January.	February.	March.	Total.
Heavy Breeds.													
W. M. Mulliner : Black Opington	24	28	25	27	29	29	28	29	25	23	18	19	304
A. R. Kennedy : Black Orpington ..	21	23	22	26	24	25	28	25	26	25	24	21	290
J. H. Madrers : Black Orpington	18	24	24	25	14	28	28	28	24	28	19	19	279
C. Watts : Black Orpington	23	12	21	25	26	27	31	26	23	25	20	20	279
C. Judson : Black Orpington	17	20	20	24	27	27	28	25	26	23	19	21	277
E. C. Lunn : Black Orpington.. . .	17	10	22	28	27	24	26	27	29	26	21	20	277
A. R. Kennedy : Black Orpington	14	26	24	24	23	27	27	21	21	25	28	21	276
A. R. Kennedy : Black Orpington .. .	16	26	24	26	29	27	31	14	26	18	13	25	275
J. H. Madrers . Black Orpington	2	13	20	24	26	30	27	27	25	25	21	23	263
A. H. Moxey : Black Orpington	3	25	25	26	25	28	27	24	24	21	20	12	260
Light Breeds.													
F. S. Longley : White Leghorn	17	12	20	24	25	29	28	27	28	24	23	20	277
H. Tout : White Leghorn	6	19	22	24	25	26	28	27	27	26	24	23	277
Alcorn Bros : White Leghorn	8	21	22	25	25	27	28	27	23	25	23	21	275
L. Graham : White Leghorn	3	22	23	24	25	25	27	27	25	25	21	24	271
Glenore Poultry Farm : White Leghorn ..	13	20	18	23	26	25	27	27	23	25	22	22	271
F. Kerr : White Leghorn	14	21	17	24	26	27	30	27	23	15	22	22	268
Leane Bros : White Leghorn	15	17	18	22	22	26	27	28	26	23	22	20	266
A. E. Jerrett : White Leghorn	8	22	23	24	22	25	26	24	21	22	21	21	259
H. A. Rogers : White Leghorn .. .	20	20	20	24	23	24	25	23	23	18	14	25	259
J. Rayner : White Leghorn	0	15	16	27	28	25	28	28	25	27	18	19	256

The Financial Aspect.

The cost of feed for the 540 birds for the year was £317 19s. 10d., representing:—

		£	s.	d.
Wheat	383 bushels 15 lb. ..	126	6	4
Maize	136 ,, 49 ,, ...	39	9	4
Pollard	803 ,, 0 ,, ...	65	11	2
Bran	341 ,, 5 ,, ...	28	3	9
Lucerne dust	2 tons 625 ,, ...	24	7	5
Green feed	83 cwt. 94 lb.... ..	4	3	10
Meat meal	14 cwt. 60 lb.	12	17	2
Common salt	322 lb. 12¼ oz. ...	1	8	11
Epsom salts	52 ,, ...	0	7	9
Shell grit	75 cwt.	15	4	2

The average cost of feed per head was thus 11s. 9d.

The market value of the eggs laid was £831 7s. 11d., so that the profit over cost of feed was £513 8s. 1d., equal to 19s. per head.

The Monthly Laying.

Month.	Section A. Light Breeds.		Section B. Heavy Breeds.		Section C1. Light Breeds.		Section C2. Heavy Breeds.	
	Total for 270 hens.	Average per hen.	Total for 210 hens.	Average per hen.	Total for 30 hens.	Average per hen.	Total for 30 hens.	Average per hen.
April, 1921 ...	1,543	5·7	1,694	8·0	44	1·5	391	13·0
May, ,, ..	2,866	10·6	2,482	11·8	83	2·8	556	18·5
June, ,, ..	3,513	13·0	3,561	16·9	215	7·2	593	19·8
July, ,, ...	4,865	18 0	4,452	21·2	433	14·4	575	19·2
August, ,, ..	5,543	20·5	4,690	22·3	585	19·5	646	21·5
September, ,, ...	6,003	22·2	4,419	21·0	654	21·8	641	21·4
October, ,, ...	6,380	23 6	4,295	20·4	679	22·6	579	19·3
November, ,, ..	5,833	21·6	3,574	17·0	637	21 2	474	15·8
December, ,, ...	5,326	19·7	3,092	14·7	562	18·7	402	13·4
January, 1922 ..	4,455	16·5	2,968	14·1	498	16·6	395	13·2
February, ,, ...	4,022	14·9	2,499	11·9	417	13·9	338	11·3
March, ,, ...	2,718	10·1	2,563	12·2	227	7·5	315	10·5
	53,067	196·5	40,289	191·8	5,034	167·8	5,905	196·9

TWENTIETH ANNUAL COMPETITION.—*Analysed.*

Section.	Eggs per Hen.	Average weight of eggs per dozen.	Value per Hen.		
	Open Light.		£	s.	d.
264 White Leghorns ...	198	27	1	11	1
6 Minorca	147	28	1	1	1
	Open Heavy.				
150 Black Orpingtons ...	197	26	1	11	11
42 Langshans	179	26	1	9	1
6 Plymouth Rocks ...	169	26	1	8	3
12 Silver Wyandottes ...	188	27	1	11	8
	Standard Light.				
12 White Leghorns ...	178	27	1	7	2
6 Black Hamburgh ...	176	27	1	5	3
6 Ancona	159	27	1	2	10
6 Minorca	148	30	1	0	5
	Standard Heavy.				
12 Langshans	189	27	1	12	7
6 Rhode Island Reds ...	188	25	1	11	9
6 Silver Wyandottes ...	188	24	1	12	3
6 Black Orpingtons ...	228	28	1	17	10

Annual Competition.

Full details of the financial and other results since the inception of the competitions are given in the following comparative table:—

		No. of Groups.	Winning Total.	Lowest Total.	Highest Monthly Total.	Average per Hen.	Greatest Value.	Average Net Price of Eggs.	Average Value per Hen.	Cost of Feed per Hen.	Balance over Feed.
1st ...		38	1,113	459	137	130	140/-	1/1	15/6	6/-	9/6
2nd ...		70	1,308	666	160	163	150/-	1/3¾	17/9	5/9¾	12/-
3rd ..		100	1,224	532	154	152	114/-	1/-	12/9	4/5½	8/3
4th ...		100	1,411	635	168	166	125/-	-/11½	13/3	5/3½	8/-
5th ...		100	1,481	721	162	171	137/-	1/0½	14/10	5/10	9/-
6th ...		60	1,474	665	161	173	149/-	1/2¼	17/2	7/-	10/2
7th ...		50	1,379	656	159	180	146/-	1/3¼	19/2	7/9½	11/4
8th ...		60	1,394	739	158	181	173/-	1/5¼	21/9	6/9	15/-
9th ...		40	1,321	658	151	168	134/5	1/2	16/3½	6/5½	10/2
10th ...		50	1,389	687	146	184	141/9	1/2½	18/5½	6/1½	12/4
11th ...		50	1,461	603	156	178	164/7	1/3½	19/4¼	7/3½	12/0¾
12th ...		50	1,360	724	152	177	145/3	1/2½	17/7	5/9	11/10
13th ...		63	1,541	705	162	181	152/9	1/2	17/8½	6/9½	10/11
14th ..		70	1,449	506	165	192	172/7	1/4½	22/2	7/7	14/7
15th	A	40	1,526	924	162	216	171/11	1/3¾	28/8¾	6/10	16/10¾
	B	30	1,479	749	165	192	171/3	1/3¾	21/7½	6/10	14/9½
16th	A	40	1,525	923	157	209	166/2¼	1/4	21/9¾	7/8	14/1¾
	B	30	1,613	931	170	202	172/3¼	1/4	21/2	7/8	13/6
17th	A	40	1,448	860	153	199	168/3	1/5½	22/0½	7/10	14/2½
	B	30	1,517	815	151	189	183/6¾	1/5½	21/11¼	7/10	14/1¼
8th	A	30	1,438	988	148	203	207/6	1/10	28/10	9/3	19/7
	B	50	1,428	745	151	190	210/7	1/10	28/1	9/3	18/10
	C1	3	1,304	977	138	195	185/8	1/10	27/8	9/3	18/5
	C2	7	1,336	955	150	191	190/7	1/10	28/5	9/3	19/2
19th	A	33	1,516	996	167	206	282/11	2/2	37/11	12/8	25/3
	B	47	1,488	955	168	204	283/-	2/2	37/11	12/8	25/3
	C1	5	1,425	944	148	195	267/8	2/2	36/-	12/8	23/4
	C2	5	1,298	1,020	150	193	244/8	2/2	35/9	12/8	23/1
20th	A	45	1,480	881	157	196	241/5	1/11	30/10	11/9	19/1
	B	35	1,457	696	160	192	252/3	1/11	31/2	11/9	19/5
	C1	5	1,092	885	144	168	164/5	1/11	24/7	11/9	12/10
	C2	5	1,370	1,092	147	197	226/9	1/11	33/5	11/9	21/8

AWARDS OF PRIZES AND CERTIFICATES.

Grand Champion Prize.

Grand Champion Prize of £5 5s. for group of six birds laying the greatest number of eggs of prescribed weight without replacement of a bird—L. Graham's White Leghorns, 1,480 eggs.

Section Prizes.

Greatest number of eggs laid in twelve months (individual hens)—

Light Breeds:—F. S. Longley and H. Tout, 277 eggs each, divide first and second prizes of £3 and £2 10s.; Alcorn Bros., 275 eggs, £2; Glenore Poultry Farm and L. Graham, 271 eggs each, divide fourth and fifth prizes of £1 10s. and £1.

Heavy Breeds:—W. M. Mulliner, 304 eggs, £3; A. R. Kennedy, 290 eggs, £2 10s.; J. H. Madrers and C. Watts, 279 eggs each, divide third and fourth prizes of £2 and £1 10s.; C. Judson, 278 eggs, £1.

Greatest number of eggs laid in twelve months (group of six birds)—

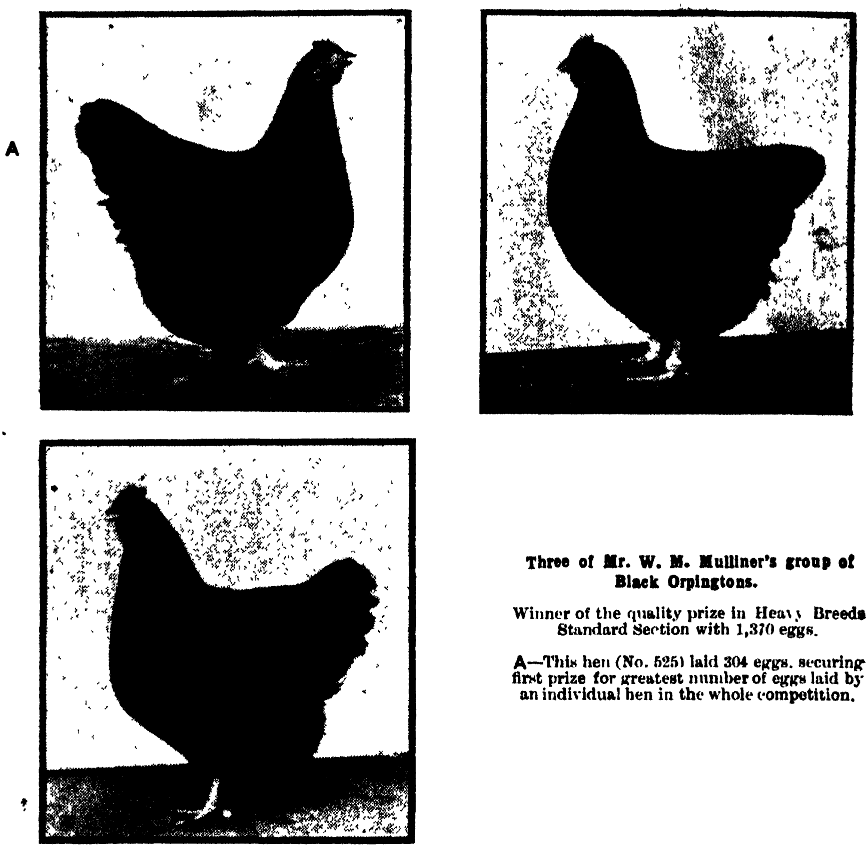
Light Breeds:—L. Graham, 1,480 eggs, £2 10s.; F. S. Longley, 1,379 eggs, £2; H. A. Gradwell, 1,343 eggs, £1 10s.; H. Tout, 1,341 eggs, £1.

Heavy Breeds:—A. R. Kennedy, 1,457 eggs, £2 10s.; C. Judson, 1,420 eggs, £2; C. Watts, 1,412 eggs, £1 10s.; A. H. Moxey, 1,387 eggs, £1.

Highest average (groups of five or six birds)—

Light Breeds:—L. Graham, 246·6 eggs, £3; F. S. Longley, 229·8 eggs, £2 10s.; H. A. Gradwell, 223·8 eggs, £2; H. Tout, 223·5 eggs, £1 10s.

Heavy Breeds:—A. R. Kennedy, 242·8 eggs, £3; C. Judson, 236·8 eggs, £2 10s.; C. Watts, 235·3 eggs, £2; A. H. Moxey, 231·2 eggs, £1 10s.



Three of Mr. W. M. Mulliner's group of Black Orpingtons.

Winner of the quality prize in Heavy Breeds Standard Section with 1,370 eggs.

A—This hen (No. 525) laid 304 eggs, securing first prize for greatest number of eggs laid by an individual hen in the whole competition.

QUARTERLY PRIZES (GROUPS OF SIX BIRDS).

Winter test (1st April to 30th June, 1921)—

Light Breeds:—L. Graham, 270 eggs, £2; J. M. Brooke, 261 eggs, £1 10s.

Heavy Breeds:—Wenholm & Seddon, 358 eggs, £2; C. Watts, 340 eggs, £1 10s.

Spring test (1st July to 30th September, 1921)—

Light Breeds:—R. G. Christie & Sons. and F. S. Longley, 414 eggs each, divide £1 10s., and £1.

Heavy Breeds:—C. Watts, 460 eggs, £1 10s.; C. Judson, 447 eggs, £1.

Summer test (1st October to 31st December, 1921)—

Light Breeds:—**J. J. Vaughan, 445 eggs, £1 10s.; R. G. Christie & Son, 441 eggs, £1.**

Heavy Breeds:—**A. H. Moxey, 412 eggs, £1 10s.; A. R. Kennedy and J. H. Madrers, 398 eggs each, divide £1.**

Autumn test (1st January to 31st March, 1922)—

Light Breeds:—**L. Graham, 380 eggs, £2; Leane Bros., 342 eggs, £1 10s.**

Heavy Breeds:—**A. R. Kennedy, 344 eggs, £2; W. W. Scott, 323 eggs, £1 10s.**

QUALITY PRIZES.

Open Sections.—**For greatest number of eggs laid by groups selected as conforming most closely to standard type. Prizes awarded subject to minimum scores of 1,200 eggs**—

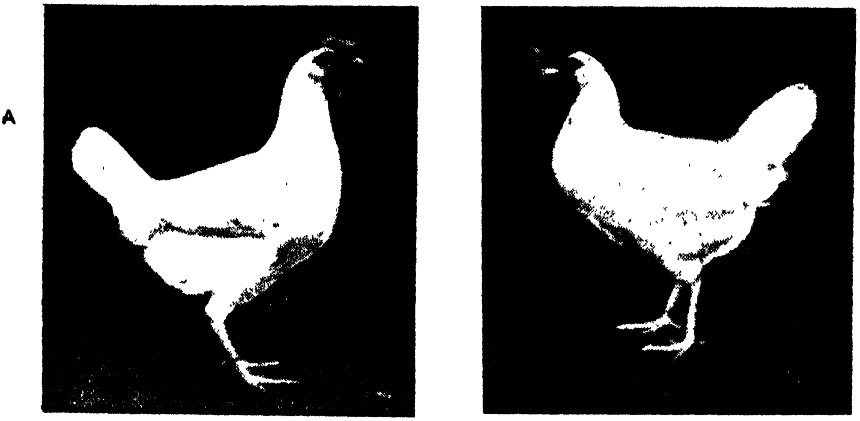
Light Breeds:—**F. S. Longley, 1,379 eggs, £5; W. Maskell, 1,244 eggs, £2 10s.**

Heavy Breeds:—**A. E. Brown, 1,220 eggs, £5.**

Standard Sections.—**For highest scores in each section, subject to minimum scores of 1,100 eggs**—

Light Breeds:—**Nil.***

Heavy Breeds:—**W. M. Mulliner, 1,370 eggs, £2; Wenholm & Seddon, 1,177 eggs, £1.**



Two of Mr. F. S. Longley's group of White Leghorns.

Winner of second prize in Twentieth Annual Competition (1,379 eggs) in Light Breeds Section

A—This hen (No. 385) laid 277 eggs and divided first prize for greatest number of eggs laid by an individual hen in the section.

THE POULTRY EXPERT'S COMMENTS.

The most outstanding feature of the 1921-22 test is the falling off of eleven eggs per hen in the general average of production. If this result were wholly attributable to the character of the competing hens the position would be regarded as serious. Happily, I am of the opinion that this is not the case. At the same time there was undoubtedly some falling off in the quality of the pullets compared with those sent in the previous year. The large number of rejections and consequent replacements that had to be made when the birds were being sent in, and the fact that many competitors were hard pressed to make such replacements, and that it was well into the third week of the competition before all these were finally settled is evidence of some falling off in quality. Doubtless the struggle for, and high price of poultry food, that ruled during the food crisis of 1920-21, was a contributing factor in this regard.

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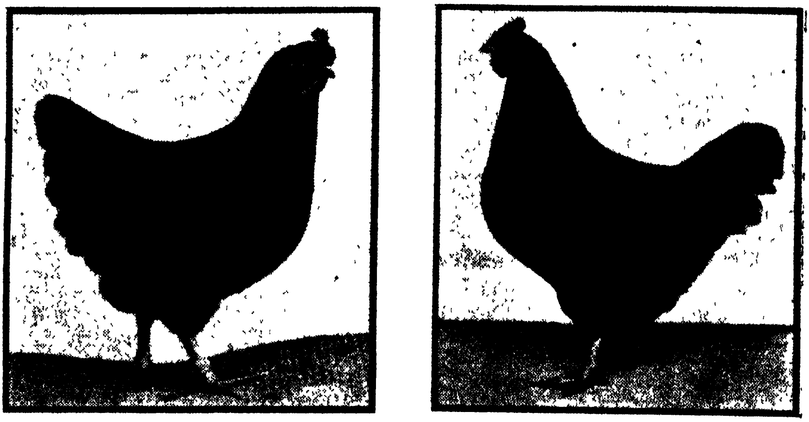
* **Minimum score was not reached and no prize was awarded.**

However, the excessive rainfall during the first two months of the competition (April and May) was, I think, much the greater factor in the falling off in average production. The rainfall registered at the College for the two months was 928 points. The next highest during the past seven years was 679 points in 1919. However, it was a fairly general experience that the egg-yield on commercial farms during last autumn and early winter was far from satisfactory. This experience is reflected in the competition.



Two of Mr. C. Judson's group of Black Orpingtons.

Winner of second prize in Twentieth Annual Competition (1,420 eggs) in Heavy Breeds Section.

Naturally there was a corresponding falling off in the groups and individual scoring, and the return over cost of feeding is affected to the extent of 6s. 3d. per hen, or a drop from 25s. 3d. to 19s. per hen. As will be seen, this lesser return is not wholly due to the lower average of eggs laid, but is represented in addition by the fact that the lower production was over the months when eggs were bringing the highest prices, and also by the fact that during the cheaper season eggs were lower in price than in the previous test, compared with the cost of feeding. For instance, the average net price of eggs for the previous test was 2s. 2d., while the cost of feeding was 12s. 8d., as compared with 1s. 11d. and 11s. 9d. respectively. Thus, while there was cheaper feeding by 11d. per hen, there was also a reduced return from eggs amounting to 5s. 4d. per hen. However, in this regard it should be remembered that the comparison is with an abnormal return per hen for 1920-21, and that this year's return is more nearly normal proportions when compared with the whole series of the competitions.

A Surprise.

An interesting feature of the test was the performance of Mr. Mulliner's Black Orpington group in the standard section. This was the first group of Orpingtons to be entered in the standard section during the three years o

its existence. It was noted that during the first two years of the existence of this standard section, Black Orpington breeders appeared to lack the courage to enter the lists. The performances of Mr. Mulliner's group become all the more noticeable from the fact that not only did one hen win the single-hen competition against all classes, but the group tied with fifth place in the open section, and would have come third for group performance in the light section. A glance at the photograph of the champion hen will show that she is not of the close-feathered class, and that she is a fair average specimen of a standard bred Orpington, with a leaning to the loose-feather character.

Another interesting Feature.

To those interested in Soldiers' Group Poultry Farm Settlement it will be interesting to note that ten settlers from group settlements were competing in this test. An analysis of their performances shows that they rather more than held their own in the averages put up by their birds. The average of the whole competition, as already stated, was 193 per hen, while the average of the ten "R.S.S." will be seen to be 194½.

EGG-YIELDS OF EACH BIRD AND GROUP IN THE TWENTIETH ANNUAL COMPETITION.

Owner and Breed.	Totals of Individual Birds.						Total of Groups.	Weight of Eggs per dozen.	Total Market-Value.		
	Open Heavy Breeds.										
								oz.	£	s.	d.
A. R. Kennedy : Black Orpingtons	275	253	202	161	290	276	1,457	26	12	12	3
C. Judson : Black Orpingtons.	277	266	211	226	185	255	1,420	25½	11	13	6
C. Watts : Black Orpingtons	‡	279	211	138	250	254	1,412	24	11	18	11
A. H. Moxey : Black Orpingtons	225	213	218	246	260	225	1,387	24¼	11	6	9
J. H. Madrers : Black Orpingtons	141	263	232	214	279	241	1,370	25¼	11	2	0
O. Ray : Black Orpingtons	238	238	183	215	230	217	1,321	24¾	10	19	1
W. W. Scott : Black Orpingtons	253	210	258	256	153	166	1,296	26¼	10	3	11
G. Jobling and Son : Black Orpingtons	230	150	258	191	259	204	1,292	26½	10	6	9
D. Kenway : Black Orpingtons	201	204	186	236	176	256	1,259	26¼	10	10	2
J. Wheller : Black Orpingtons	243	215	165	191	200	242	1,256	24½	10	1	0
E. C. Lunn : Black Orpingtons	277	183	179	258	240	168	1,255	26¾	9	16	1
A. S. Green : Black Orpingtons	218	259	177	158	‡	248	1,242	24	10	2	0
A. Chick : Black Orpingtons	191	234	212	194	254	138*	1,223	25½	9	9	3
A. E. Brown : Langshans	214	199	122	207	250	228	1,220	25¼	10	2	2
E. Maher : Black Orpingtons	256	100	105	211	‡	258	1,211	25¾	9	16	9
T. McDonald : Black Orpingtons	232	184	‡	193	247	119	1,191	26	9	17	8
Woodlands P. Farm : Silver Wyandottes	144	203	182	201	226	195	1,151	27	9	16	8
G. Gurney : Langshans	168	216	211	212	242	81	1,130	26¼	9	6	10
J. Every : Langshans	215	222	†198	213	180	*99	1,127	27	9	5	5
A. Collier : Langshans	245	243	†15	198	219	199	1,119	27	9	3	6
W. H. Forsyth : Silver Wyandottes	151	213	*156	172	256	154	1,102	26½	9	3	3
R. Garlick : Black Orpingtons	187	219	239	†94	161	197	1,097	26¾	8	13	9
H. R. Woolf : Langshans	‡	‡	241	163	176	‡	1,093	24	9	3	7
W. T. Sinclair : Black Orpingtons	199	187	184	190	‡	169	1,082	26¼	8	7	0
R. H. Upton : Black Orpingtons	174	201	178	202	204	110	1,069	25¾	9	4	5
J. Sands : Black Orpingtons	4†	168	124	245	259	248	1,048	25½	8	5	0
C. Faulkner : Black Orpingtons	221	239	‡	21†	211	172	1,015	24½	8	3	4
J. D. Martin : Plymouth Rocks	94†	209	215	237	247	11	1,013	26¼	8	9	6
C. H. Gerrard : Black Orpingtons	197†	‡	87†	154*	181	172	1,006	25¼	8	15	10
W. E. Webster : Black Orpingtons	170†	187	178*	114	165	162	976	27	7	13	4
F. Rivers : Langshans	138	‡	146†	244	214	130	947	26¼	7	16	3
W. H. Whittorn : Black Orpingtons	126	252	102†	236	151*	80†	947	25¼	7	8	8
J. Roberts : Black Orpingtons	213	131	164	186	213	..	907	28½	7	6	0
Mrs. R. N. Makin : Langshans	179	14	109	175	192	205	874	26	6	4	8
Mrs. C. B. Ferguson : Black Orpingtons	190	25	156†	64	79	182	696	26¼	5	9	10

* Signifies bird replaced, score struck out. † Signifies bird dead, score retained.

‡ Signifies bird disqualified (Rule 8) not having laid eggs of prescribed weight ; individual score not published.

EGG-YIELDS OF EACH BIRD AND GROUP IN THE TWENTIETH ANNUAL COMPETITION—*continued.*

Owner and Breed.	Totals of Individual Birds.						Total of Groups.	Weight of Eggs per dozen.	Total Market Value.		
								oz.	£	s.	d.
Open Light Breeds.											
L. Graham : White Leghorns	211	‡	233	271	245	246	1,480	24	12	1	5
F. S. Longley : White Leghorns	277	183	221	‡	209	236	1,379	26¾	10	19	5
H. A. Gradwell : White Leghorns	230	229	252	202	191	239	1,343	28¼	10	7	4
H. Tout : White Leghorns	200	277	188	247†	210	219	1,341	25¼	10	8	5
R. G. Christie and Son : White Leghorns	215	238	194	223	230	210	1,310	27	9	19	3
H. J. Cox : White Leghorns	201	219	253	231	188	218	1,310	26¼	10	6	8
Leane Bros. : White Leghorns	191	200	234	218	200	266	1,309	27	10	2	6
Glenore Poultry Farm : White Leghorns	217	271	229	249	151	183	1,300	28	10	8	6
H. L. Abrook : White Leghorns	245	244	191	255	174	186	1,295	27	10	4	1
Watson and Stepney : White Leghorns	204	202	210	238	227	202	1,283	27¼	9	19	8
J. M. Brooke : White Leghorns	213	228	236	181	247	176	1,281	27¼	10	8	6
A. Sindel : White Leghorns	212	186	185	221	236	233	1,273	27¼	9	18	1
W. Maskell : White Leghorns	198	231	246	200	205	164	1,244	27¼	11	3	7
B. Clarke : White Leghorns	188	240	252	185	188	184	1,237	27	9	9	7
C. M. Larsen : White Leghorns	216	188	209	212	210	196	1,231	27	9	12	6
W. H. Cole : White Leghorns	220	142†	235	236	194	203	1,230	26¾	9	13	8
J. J. Vaughan : White Leghorns	208	236	171	211	204	200	1,230	25¼ *	9	5	0
F. Kerr : White Leghorns	208	211	222	176	150	199	1,226	26¼	9	13	10
G. Dunlop : White Leghorns	213	206	171	207	223	204	1,224	26	9	15	1
Alcorn Bros. : White Leghorns	192	246	275	219	54	229	1,215	25¼	9	11	0
T. S. Dwyer : White Leghorns	203	155	189	209	237	222	1,215	29¼	9	12	0
Mrs. M. Chalmers : White Leghorns	189	230	210	147	249	187	1,212	26½	9	14	4
A. E. Jerrett : White Leghorns	215	259	120	207	195	214	1,210	28¼	9	12	4
C. C. Kennett : White Leghorns	174	239	198	222	157	207	1,197	27¼	9	15	4
D. Asher : White Leghorns	209	202	146	236	182	212	1,187	27¾	9	11	6
A. Asher : White Leghorns	193	218	228	‡	171	150	1,187	24¾	8	19	2
W. G. Dickie : White Leghorns	209	212	173	250	163	154	1,161	27	9	0	6
W. McKnight : White Leghorns	188	184	194	174	201	215	1,156	26¼	8	15	5
F. A. Bailey : White Leghorns	142	†	232	188	221	163	1,150	24½	9	7	9
W. J. Buckland : White Leghorns	233	229	228	67†	188	205	1,150	28½	8	8	2
H. C. Bailey : White Leghorns	179	213	215	170	156	210	1,143	28¼	8	15	6
J. R. Stewart : White Leghorns	212	188	192	83	194	236	1,105	26	8	17	10
Mrs. C. Lewis : White Leghorns	144	‡	196	‡	164	198	1,105	24	8	8	11
L. A. Beckett : White Leghorns	194	143	202	219	136	202	1,096	27¼	8	8	0
M. C. Byrne : White Leghorns	209	224	219	249	170	16†	1,087	25¼	8	14	2
H. S. Morris : White Leghorns	225	43	202	188	201	227	1,086	25¾	8	10	11
J. Rayner : White Leghorns	155	125	171	206	256	165	1,078	27¼	8	4	6
R. Whitelaw : White Leghorns	47	194	219	220	167	224	1,071	25¼	8	7	8
G. A. Baxter : White Leghorns	191	139	174	182	165	205	1,056	27	8	0	3
J. Anderson : White Leghorns	253	193	237	138	131	93	1,045	26	8	8	6
H. A. Rogers : White Leghorns	205	12†	259	216	230	104	1,026	27	8	8	1
C. Leach : White Leghorns	204	‡	236	39	218	201	928	25¼	7	7	9
Elliott Bros. : White Leghorns	161	57	92	226	198	174	908	28¼	6	18	1
Willow Grange Poultry Farm : White Leghorns	170	88	157	130	183	166	894	25¼	6	11	7
A. W. Cloke : Minorca	247	167	189	119	179	82	983	27¼	6	6	7
Standard Light Breeds.											
R. R. Brown : White Leghorns	172	163	216	194	171	176	1,092	27	8	4	5
Turner Bros., Black Hamburgh	160	187	170	159	187	192	1,055	27¼	7	11	7
A. Messervy : White Leghorns	9†	210	210	193*	190	236	1,048	26¾	8	1	8
Anrol Poultry Farm : Auconas	125	186	155*	179	163	146	954	28¾	6	17	0
C. A. Clarke : Minorcas	111	183	190	183	122	96	885	30¼	6	2	4
Standard Heavy Breeds.											
W. L. Mulliner : Black Orpingtons	211	239	304	189	233	194	1,370	28¼	11	6	9
Wenholm and Seddon : Langshans	223	155	205	153†	233	208	1,177	26¼	10	4	8
J. Waterhouse : Rhode Island Reds	145	161†	245	233	163	184	1,131	25	9	10	8
F. M. Weierter : Silver Wyandottes	206	30†	274	258	210	153	1,131	24¼	9	13	8
W. L. Pert : Langshans	241	152	172	220	126†	181	1,092	27¾	9	2	4

* Signifies bird replaced, score struck out. † Signifies bird dead, score retained.

‡ Signifies bird disqualified Rule 3) not having laid eggs of prescribed weight; individual score not published.

Pure Seed.

GROWERS RECOMMENDED BY THE DEPARTMENT.

THE Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Wheat **:—**

Bomen	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
	H. M. Hall and Sons, Studbrook, Cunningar.
College Purple	Hughston Bros., Marsden-street, Boorowa.
Currawa	T. J. A. Fitzpatrick, Erin Vale, Warre Warral.
Florence	Manager, Experiment Farm, Trangie.
	Manager, Experiment Farm, Coonamble.
	Manager, Experiment Farm, Glen Innes.
Gresley	Manager, Experiment Farm, Cowra.
	Gollasch Bros., Milbrulong.
Hard Federation	H. M. Hall and Sons, Studbrook, Cunningar.
Marquis	Manager, Experiment Farm, Glen Innes.
Penny	E. J. Allen, Gregra.
	H. M. Hall and Sons, Studbrook, Cunningar.
Sunset	Manager, Experiment Farm, Coonamble.
	Manager, Experiment Farm, Nyngan.
Waratah	Manager, Experiment Farm, Cowra.
Warden	Manager, Experiment Farm, Cowra.
	Gollasch Bros., Milbrulong.
	B. J. Stocks, Linden Hills, Cunningar.
	H. M. Hall and Sons, Studbrook, Cunningar.
Warren	Manager, Experiment Farm, Trangie.
Yandilla King	B. J. Stocks, Linden Hills, Cunningar.

Oats **:—**

Algerian	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Glen Innes.
Guyra	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Glen Innes.
Ruakura	Manager, Experiment Farm, Glen Innes.
Sunrise	Manager, Experiment Farm, Glen Innes.

Barley **:—**

Cape	Manager, Experiment Farm, Bathurst.
Kinver	Manager, Experiment Farm, Temora.
Trabut	Manager, Experiment Farm, Cowra.

Rye **:—**

Black Winter	Manager, Experiment Farm, Bathurst.

Clovers **:—**

Shearman's Clover (roots)	J. H. Shearman, Fullerton Cove, Stockton.

In addition to those tabulated a number of crops were inspected and passed, but as the growers failed to forward samples their seed has not been listed.

Poultry Notes.

MAY.

JAMES HADLINGTON, Poultry Expert.

FOLLOWING on the advice given in these notes last month in respect of matings, the time has now arrived when the breeding pens should be made up, and, if possible, a test for fertility of eggs might be made during this month, particularly so where doubt exists on the score of age or condition of the birds mated. On a commercial poultry farm where many hundreds of chickens have to be hatched, one cannot afford to risk the waste of time that might occur through mishaps in the matings. Some of the birds are almost sure to prove more or less unsatisfactory, and it is to find these out with a view to remedying the trouble, if possible, that these trial runs of a small number of eggs from each pen is worth while.

Be Ready.

The first week in June should see the first batches of eggs for the hatching season put down. It is, of course, not expected that eggs will be plentiful thus early in the winter, but, providing a reasonable proportion of the birds mated are young, there should be at least a number of eggs available for incubation. Where this is not the case, one would expect to find something wrong either with the management of the birds, or the ages and conditions that have been penned to breed from. This, of course, refers to developed farms. On the other hand, the starter with a small number of birds may find that, notwithstanding all the care he may have bestowed upon his birds and the breeding of them, from one cause or other his limited number of birds are not laying. This is often a dire discouragement to the novice, but such experiences are inevitable. If proof on this point is required we can turn to the Egg-laying Competitions for evidence. There it will be found that, notwithstanding all the care exercised by the competitors in selection and the good conditions under which the birds are run and tended, there are still many groups of pullets that are laying but very few eggs up to June. This is mentioned to dispel some of the illusions under which the less experienced labour. It is as well to remember that such cases often occur from causes over which perhaps no one has any control.

It has been previously pointed out in these notes that while pullets are expected to come on to lay at such and such ages, it is but a comparatively small number that do so consistently until near the end of the winter. Nor should pullets be condemned as bad layers on that account. Many potentially good laying pullets succumb to vicissitudes to which they are liable, and make but a poor performance during the early part of the winter. It follows, of course, that birds that do not lay fairly well during the winter are not likely to put up any sensational records for the simple reason that there is no time in which to make them, but competition tables show that it is not an unusual thing for pullets that have failed badly during the early winter to still put up well over 200 eggs in their first year of laying.

However, it must be recognised, notwithstanding what has been said in this regard, that much of the poor performances of pullets during the season when eggs are scarce is due more or less to mismanagement of them, either in respect of feeding, housing, or environment, one or all, in addition to which there are the general vicissitudes of weather, &c., to which some pullets are more susceptible than others.

This all goes to show that the skill of the attendant is a big factor in securing results.

Heavy Versus Light Breeds.

When discussing early hatching, one is often met with a question as to the advisability of hatching light breeds such as Leghorns so early as June. My reply is that June is not too early to hatch some of any breed, and particularly so when it is considered how few can be hatched in that month, when we do not commence to put eggs down until the first week of it. It follows that, in view of the circumstances already referred to, even if we start in June it is scarcely practicable to have many chickens out before July, and that month is certainly not too early to hatch stock from which it is intended to select breeders the following year. And here it might be remarked that to have only a small number of early birds from which to select our breeders is to set too narrow a limit to our selections, which is fatal to the continuous breeding of a good uniform standard of quality. Even with flocks of good quality, for every bird wanted as a breeder we must have at least three to choose from, or our selections will be poor.

From this it follows that where more than one breed is kept it is imperative that some of both should be hatched early. At the same time it might be borne in mind that, taking general averages, heavy breeds require to be a month older than light ones for expectations of laying.

It therefore follows that to some extent preference should be given to getting out the bulk of the number of heavy breed chickens required during the earlier months—June, July, and August—while it should also be recognised that September is somewhat late to hatch heavy breeds and quite late enough for light. This holds good with slight modifications for even the cooler portions of the State.

The old notion that June and July is too early to hatch in the cool districts should be abandoned, and an endeavour made to hatch early. When once this old idea is abandoned with a determination to have earlier chickens, it comes to be realised that what was regarded as impossible is comparatively easy of attainment after all.

Uniformity Necessary.

In looking over the breeding pens on some commercial farms, anyone who knows what should be cannot but be struck with the lack of uniformity in the pens of birds mated up for breeding purposes. Large and small, weak and strong, good types and bad—some very bad—mated together. What can the "harvest" (the chicken crop) be?

When such cases are met with one naturally inquires the "why" of such want of uniformity, and is invariably informed that those small hens are specially good layers or they are deemed to be so in prospective. In some instances the disparity in size, type, &c., has not even been noted. In such cases the first thing that occurs to the practical breeder is, that if it is desired to breed from such birds why not classify and grade them; if this was done then the farmer would be in a better position to note the results from the different class of matings, and the object lesson gained would, in all probability, be such that he would not repeat some of the matings another year, and a valuable experience would be gained.

To better illustrate this point, it might be stated that cases have come under the writer's notice where the disparity among hens in the same breeding pens has been as great as from 3 lb. to 6 lb., and in quality on the "utility score card" the points would range from 60 to 90. It will be seen what scope exists in many instances for improvement in our flock on the score of uniformity alone.

The two things necessary are, first, attention to the facts as stated in regard to size, to determine which no skill is required, and next that every breeder should make a study of the type of the breed he is handling. One of the best signs that the commercial poultry farmer is at last awakening to the necessity mentioned is the interest he is now taking in the utility classes provided in poultry shows, and the vast improvement in the quality so far shown this year as compared with previous years. In this regard the writer is tempted to think that the castigation given to exhibitors a year or two ago when he stated that of his own knowledge many poultry farmers had much better birds in their yards than they exhibited in the shows, has not been barren of results.

Unfortunately, many have a similar lesson to learn with regard to their selection of pullets to compete in the Egg-laying Competition. In this case it is quite obvious each year that competitors in many instances rely too much upon pedigree and too little on selection. More skill in selection, it is safe to predict, would raise our general averages in these competitions by ten to twenty eggs per hen. If this is the case in connection with competitions, it can well be imagined how much better results will be obtained on the average poultry farm as a result of greater skill in the selection of the breeders.

Orchard Notes.

MAY.

W. J. ALLEN and W. le GAY BRERETON.

EVEN in the late apple and pear districts, growers will have practically completed their harvesting by this month.

Before starting on the winter work, the packing shed should be given a complete cleaning up ; any cases that have been used to hold fruit during the season should be dipped, and packing benches and stands should be washed down with boiling water containing a disinfectant. This should be done not only to catch any codlin grubs that have emerged from infected fruit, but also to check the accumulation of such fungus diseases as ripe or bitter rot.

Pests.

It is advisable to leave the bandages on apple and pear trees till towards the end of winter, as often after winter rains and cold codlin grubs will shift from other hiding places to the more secure shelter of the bandages, where they can be caught and killed.

Where woolly aphis has made headway unchecked during the busy time of the picking season, the trees should be sprayed with tobacco wash or one of the commercial extracts.

When spraying for aphis, use high pressure not under 180 lb., and hold the nozzle close to the affected parts ; in other words, use a "drenching" spray not a "mist" spray, in order to break up the clusters.

Spraying in this manner uses a large amount of spray per tree, and if the aphis is thick on big trees quite a pool will accumulate around the butt, and for this reason it is preferable in treating for woolly aphis to use a harmless spray such as tobacco rather than an oil spray.

Where citrus trees are infected with scale insects which have not been dealt with earlier, they can still be fumigated, for a satisfactory kill can even yet be obtained, but the red scale, though killed, may not crack off the fruit by picking time.

Other Work.

Provided the land is not too soft from rain, it is a good time to cart out to the trees any farmyard manure or other refuse that will rot and form humus, or to carry out any re-soiling or drain-making that is necessary.

Where large areas are to be pruned, a start can be made this month on such deciduous trees as peaches or Japanese plums, which lose their foliage early, but if one is not pressed for time this is better left till next month.

Those intending to plant peaches should select good canning varieties in preference to dessert varieties if the district is suitable for the production of that class of peach. The following are some of the best canning varieties in their order of ripening:—Pelora, Levis, Sims, Phillip's Cling, Golden Queen, Goodman's Choice, Pullar's Cling.

It is important in selecting varieties to extend the season with a view to avoiding congestion during the canning season. As Pullar's Cling is a great favourite and has been largely planted both in this and other States, it would be wise to plant more heavily with other varieties.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1922.

Society	Secretary.	Date.
Wellington P. A. and H. Society	A. E. Rotton	May 9, 10
Lower Clarence A. Society (Maclean)	E. D. Munro	,, 10, 11
Dungog A. and H. Association	W. H. Green	,, 10, 11, 12
Dubbo P. A. and H. Association	F. Weston	,, 17, 18
Coonamble P. and A. Association	J. C. Wilson	,, 23, 24
Warren P. and A. Association	A. C. Tompson	June 7, 8
Murrumbidgee P. and A. Association (Wagga)	A F. D. White	Aug. 22, 23, 24
Corowa P. A. and H. Society	**J. D. Fraser**	,, 29, 30
Grenfell P. A. and H. Association	G. Cousins	,, 29, 30
Gunnedah P. A. and H. Association	M. C. Tweedie	,, 29, 30, 31
Junee P. A. and I. Association	T. C. Humphreys.	Sept. 5, 6
Young P. and A. Association	T. A. Tester	,, 5, 6, 7
Northern A. Association (Singleton)	J T. McMahon	,, 7, 8, 9
Cootamundra A. P. H. and I. Association	Wm. A. Sowter	,, 12, 13
Cowra P. A. and H. Association	E. P. Todhunter	,, 12, 13
Holbrook P. A. and H. Society	Jas. S. Stewart	,, 19, 20
Temora P. A. H. and I. Association	A D. Ness	,, 19, 20, 21
Murrumburrah P. A. and I. Association	W. Worner	,, 26, 27
Narrandera P. and A. Association	W. H. Canton	,, 27, 28
Ganmain A. and P. Association	A. R. Lhuede	,, 12, 13

1923.

Newcastle A. H. and I. Association	E. J. Dann	Feb. 27, 28, Mar. 1, 2, 3
Central New England P. & A. Assoc. (Glen Innes)	Geo. A Priest	,, 6, 7, 8

In value, the strawberry crop in the United States is surpassed among fruits only by the apple, peach and grape. The value of the crop in 1909, according to the thirteenth census, was 125 dollars per acre, as compared with an average value of about 15 dollars per acre for the wheat and maize crops.—United States *Farmers' Bulletin*, 1,028.

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Agricultural Gazette of New South Wales.

Farmers' Experiment Plots.

POTATO EXPERIMENTS, 1921–22.

Upper North Coast District.

W. D. KERLE, Inspector of Agriculture.

THE farmers who co-operated with the Department in field experiments with potatoes in the season 1921-22 were:—

R. W. Hindmarsh, "Wiaraga," Bellingen, Bellinger River.
F. L. Playford, "Merrylands," Glenreagh, Orara River.
H. Johnson, Condong, Tweed River.
Henry Short, "Warrawee," Dorrigo.
M. McBaron, "Riverview," Raleigh, Bellinger River.
E. N. MacKinnon, "Birchgrove," Tyndale, Clarence River.
Garrett Long, "Glengarry," Tatham, Richmond River.
A. Eggins, "Bromley," Grafton, Clarence River.

The Season.

The disastrous floods of the winter of 1921 were followed by a dry spring, and the greatest difficulty was experienced in getting the ground into a fit condition for planting. In some places heavy deposits of silt made preparation even more difficult, but the land has benefited greatly, and the benefit will be particularly felt in the next few years. Except in the Bellingen and Dorrigo districts, the season could not be considered favourable for potatoes. Dry weather followed the planting of the early crops for three weeks; slightly improved conditions ruled in September, but very dry with high temperatures obtained in November when rain was most required.

On the Bellinger the rainfall averaged 3½ inches each month, and was well distributed, and the yields were in consequence much heavier. The Dorrigo, which, owing to its elevation (2,500 feet), has a totally different climate from the rest of the coast, commenced the season well with moderate falls, but the middle of December saw heavy and continuous downpours with low temperatures, sometimes almost like midwinter. Irish blight developed in the crop just after the flowering stage, and killed off the haulms in a few days, reducing the yields fully three-fourths. Except for slight attacks by the 28-spotted ladybird in isolated plots, the season was free from insect pests.

New Varieties.

Several varieties were tried for the first time this season.

Scottish Triumph.—White skinned, early maturing variety; medium in size, shallow eyes; growth of haulm rather sparse; hardy; did remarkably well at Dorrigo, where it outyielded all other varieties.

Dalhousie.—White skinned, few eyes, shallow; foliage similar to Scottish Triumph; flowers light pink; leaves light green; matures a fortnight later than Satisfaction; tubers rather small; cooking qualities satisfactory.

Arran Chief.—White skin; midseason to early; poor keeping quality; medium sized tuber; rough skin; good cooker.

Tasma (Commersoni Italiana).—This variety is from Tasmania; grown at Dorrigo for first time. White skin, oval shaped tuber, medium to large in size; growth of haulm very robust, sturdy stems, leaves dark green; flower pink, with yellow centre; one of best plots in the Dorrigo trial before it was attacked by Irish blight, which affected it to the same extent as other midseason varieties; good keeper, excellent for table.

Bismarck.—An old variety, much grown in Tasmania, but included in Dorrigo trials for the first time. Very early maturing, but seems particularly susceptible to Irish blight; tuber very distinctly yellowish skinned, with purple eyes; rather numerous; oblong shaped; large size; appears to be rather a poor keeper; foliage very dark green, flowers dark purple; growth of tops at Dorrigo very robust, but first variety to go off with blight.

Cooke's Favourite.—This variety was grown at Dorrigo for trial next season; white skinned, similar to Up-to-date; good cooking and keeping qualities, and promises to yield well.

Blue Imperial.—Grown with a view to inclusion in 1922-23 plots at Dorrigo. Deep blue-skinned variety, with snowwhite flesh; large size; midseason; striking foliage, large leaf of dull green colour, deep blue-coloured stems, and deep purple and white flowers with yellow centre; very robust, open habit of growth; seen on 13th December, when in flower, this plot was the most even and healthiest of all the varieties in the experiments, but it went off very quickly a fortnight later when Irish blight made its appearance.

The Rainfalls.

The rainfall recorded at each of the centres from sowing to maturity was:—

Month.	Bellingen.	Dorrigo	Glenreagh.	Condong	Tatham	Tyndale.	Grafton	Raleigh.
1921.	Points from 26th	Points	Points. from 10th	Points.	Points.	Points from 21st	Points from 12th	Points.
August ..	101		20	...	.	65	28	
September...	362	from 23rd 2	265	from 22nd 124	from 7th 269	580	398	.
October	343	306	189	158	129	176	333	343
November .	340	411	Nil to 10th	155	99	Nil to 10th	88	340
December	..	1,663	...	1,305	209 to 16th	..	.	1,196
Total ..	1,146	2,382	474	1,742	706	821	847	1,879

Cultural Details and Comments.

Bellingen.—Soil, alluvial loam, fertile; previous crop maize; tilth excellent; rows 3 ft. 3 in. apart, sets 12 inches in drills 5 inches deep. Experiment of eight varieties uniformly manured with superphosphate at 2½ cwt. per acre; seed from Dorrigo, sound and well sprouted. Germination of all plots excellent, and subsequent growth of haulms very luxuriant, particularly of Surprise and Brownell's Beauty; sowing made on 26th August. Season satisfactory; heavy rain fell in December (12 inches) after the crop was mature, which delayed harvesting, but did not affect the yield; rainfall of 11·46 inches in growing period evenly distributed. Foliage slightly eaten by 28-spotted ladybird, and Irish blight was noticeable in Early Manistee, but, fortunately, weather conditions did not favour its development. Yields high for locality. In Surprise plot tubers large and uniform, and 14 lb. exhibited at Bellingen show defeated all entries in pink skins. Factor and Up-to-date yielded well, but had greater percentages of unmarketable tubers. An experiment to determine the effect of dipping the cut sets in lime was conducted with Brownell's Beauty, but proved in favour of the untreated plot. These plots were grown side by side, and consisted of two rows each 6 chains long. The yields obtained were:—

	t.	c.	q.	lb.	
Untreated	9	0	3	20	per acre.
Limed	8	12	1	0	,,
Increase	0	8	2	20	,,

Glenreagh.—Soil clay loam, light reddish colour, typical of Orara River banks. Ground prepared early in July and covered by flood on 23rd. Reploughed and harrowed 1st August, planted 8th to 10th August; previous crop, maize for ten years continuously; germination of Scottish Triumph 95 per cent., Up-to-date, Carman No. 1, and Brownell's Beauty 90 per cent., Early Manistee 85 per cent., Factor 65 per cent., Manhattan 50 per cent., Satisfaction 40 per cent. After cultivation—harrowed 31st August; scuffled 19th and 27th September; hilled and middled 5th October. Yields at this centre were light, due to washing away of surface soil by flood waters and low rainfall during growth of crop. In July, 15·29 inches of rain fell, and only 4·74 inches for the next three months. The returns from Factor, Satisfaction, and Brownell's Beauty were greatly reduced by poor germination.

In the manurial trial both P9 and M7 (new mixtures containing chloride of potash) gave substantial increases over unmanured plots, while P7 and superphosphate alone did not give sufficiently large increases to cover cost of application. No doubt a fair proportion of the fertiliser was not utilised by the plant owing to the dryness of the season.

Dorrigo.—Soil, red volcanic loam; previous crops, potatoes 1918, maize 1919 and 1920; rows 2 ft. 6 in. apart, sets 12 inches apart; drills 4 inches deep; ground twice ploughed and several times harrowed and in excellent condition when planted on 21st and 22nd September. Rainfall during growth 23·82 inches, 16·63 inches of which fell in December. Seed was obtained from last season's crop and was well sprouted; with exception of Arran Chief, of which only about 50 per cent. came up, seed being inferior; all plots germinated excellently. Inspected on 3rd December, ten weeks after planting crop; flowering, haulms 2 feet to 3 feet high and meeting between the rows; an ideal crop. Irish blight noticeable on leaves and base of stems

Results of Variety Trials.

Variety.	Dorrigo.				Bellingen.				Raleigh.				Condong.				Glenreagh.				Tatham.				Tyndale				Grafton.			
Date Sown ..	21st-23rd Sept.				26th-27th Aug.				28th-29th Sept.				22nd-23rd Sept.				8th-10th Aug.				7th-8th Sept.				19th 20th Aug.				11th-12th Aug.			
	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.	t.	c.	q.	lb.
Scottish Triumph ..	6	10	0	0	....				7	10	0	0	... ..				2	6	2	6	....				2	16	1	18	2	19	2	0
Satisfaction ...	6	1	0	20	6	8	0	0	6	8	2	8	6	12	3	12	1	10	3	5	....				2	1	1	0	1	13	0	0
Factor	5	16	1	0	8	12	3	20	7	13	0	0	6	2	0	16	1	15	0	7	2	19	3	14	3	0	0	0	1	19	0	0
Up-to-date	5	15	0	16	7	13	3	0	8	3	0	0	7	13	2	10	4	11	0	5	3	18	2	0	3	13	2	12	4	9	1	0
Coronation... ...	5	4	2	0	....				....				... . .				....				....				....				....			
Dalhousie	5	1	2	0	... .				....				....				....				4	10	1	16	1	17	1	0	....			
Langworthy .	5	0	0	2	.... .				....				... ...				....				....				... .				....			
Early Rose... ...	....				7	8	0	0	....				6	8	2	8	... .				1	17	3	20	....				....			
Carman No. 1 ..	4	12	1	0	... .				8	5	2	24	....				2	12	3	16	5	2	3	0	1	17	3	0	.. ..			
Early Manistee ..	4	8	2	8	5	15	2	22	8	5	3	20	9	8	2	12	2	18	3	20	....				1	18	1	17	....			
Tasma	4	6	2	14	.. .. ..				....				... . ..				......				....				.. ..				....			
Plunkett's	4	2	2	18	.. ... .				....				.. .. ..				.. ... .				.. . ..				....				... .			
Early Manhattan ..	4	2	0	0	....				8	13	2	8	8	7	1	0	1	12	0	13	5	18	0	10	2	0	3	0	2	2	2	0
Surprise	3	0	2	14	8	15	2	22	....				.. ..				... .				... .				....				. ...			
Bismarck	2	14	1	18	. ...				. .....				.. . ...				. .				....				....				....			
Improv'd Brownell's Beauty.	2	9	1	0	6	12	1	12	.. .. ..				.. .. .				.. .. ..				....				....				..... .			
Arran Chief ..	2	1	1	20	.				.. ..				. ..				... .				....				....				1	18	3	0
Brownell's Beauty	....				9	6	1	24	....				7	10	0	0	2	2	2	25	....				1	10	1	17	3	6	3	21

of Early Manistee and Bismarck; only dry and hot conditions could prevent disease from spreading. Unfortunately six days later 135 points of rain fell, followed by dull, misty weather, a further 58 points on 14th, and from 21st to 31st heavy and incessant rain, totalling 14·70 inches accompanied by phenomenally low temperatures; effect on potato crops disastrous; haulms quickly reduced to a black mass of diseased foliage; disease spread to tubers, but not to a very great extent. Yields reduced fully 75 per cent. owing to attack occurring long before maturity. The previous season's crop was attacked by Irish blight in exactly the same manner. This season's sowing was made nearly three weeks earlier, in an endeavour to escape the moist conditions invariably experienced in January; the rainy weather occurred coresspondingly earlier, however, with similar effects on the crop.

The Potato Variety Trial at Dorrigo.

From left to right.—Surprise, Carmen No. 1, Early Manistee, Up-to-Date, Satisfaction.

Highest yield obtained with Scottish Triumph, a new white-skinned variety, tried here for the first time. Arran Chief germinated so badly as to afford no comparison with other varieties in point of yield. No varieties appeared to show any immunity to Irish blight. The earliest varieties yielded best, being nearer to maturity when attacked. The difference due to fertiliser is always noticeable on the Dorrigo, although perhaps not so substantial this season. When in flower the difference on the fertilised plots was most noticeable in the growth of haulms and particularly where P9, M7, and superphosphate 5 cwt. had been used.

Several new varieties were received by Mr. Short from the Department to increase the supply of seed for future sowings when they will be compared with standard varieties. These were:—Batlow Red, Great Scott, Lochar, The Bishop, Arran Rose, Arran Comrade, Irish Queen, Golden Wonder, Blue Imperial, and Cooke's Favourite.

The fact that Irish blight has attacked the potato crops on the Dorrigo for two years in succession and three times in the last eleven years, reducing ideal crops to comparatively nothing, must be regarded very seriously by local growers. The soil of the plateau is particularly suitable for potatoes, and a very big increase in acreage is anticipated when railway connection with the North Coast line (now in course of construction) is completed. It is apparent that the industry will be seriously menaced by Irish blight if preventive measures are not adopted. Spraying with Bordeaux mixture is a sure means of control if carried out in a proper manner.

Condong.—Soil, alluvial loam; Tweed River bank land; site covered by floods in May and again in July, when under winter fodders, leaving 2 inches silt; ploughed three times; planted 22nd September; drills 2 ft. 9 in. apart. Season very favourable, 17·42 inches of rain falling during growth of crop; rainfall for year 1921, 101·48 inches. Factor did not germinate well. Plots made rapid growth, having healthy appearance and luxuriant foliage; ultimate yields high for the district. The 1920-21 experiments also showed substantial increases from the use of fertilisers, and it would seem that very payable results can be obtained from fertilisers, even on soil which is undoubtedly fertile.

The Plots of Surprise and Carmen No. 1 at Dorrigo.

The yields were reduced fully 75 per cent. by Irish Blight.

Tatham.—Soil, alluvial black loam; previous crop broadcast maize; ploughed first on 1st August and twice after, land being in excellent tilth for sowing on 7th September; site covered by flood in July and left ½ inch deep with silt. Rows 3 feet apart and sets 18 inches apart in drills. Percentage of germination estimated at Manhattan 95 per cent., Surprise 60 per cent., and other varieties 75 per cent. Rainfall recorded during growth 7·06 inches, but temperatures being very high moisture was inadequate. particularly in November, the critical stage. The crop was free from disease and harvested on 23rd December. The yield of Surprise was not taken, its results not being comparable owing to poor germination.

Tyndale.—Site of experiments (Woodford Island, fronting Clarence River), alluvial loam, worked for forty years, mostly under sugar-cane. Soil badly set after heavy July rains, and with difficulty brought to a fair tilth at sowing on 19th and 20th August. All varieties germinated satisfactorily, but growth of haulms not good and yields light, due to hot and dry conditions; thorough after-cultivation conserved what moisture fell, and was largely responsible for the returns; harrowed on 31st August, scuffled on 19th and 26th September and 6th and 17th October; hilled on 26th October. Three white-skinned varieties headed the list—Up-to-Date, Factor, and Scottish Triumph, but yields were low. Early Manhattan gave very poor results in comparison.

The Potato Manurial Trial at Dorrigo.
With 5 cwt superphosphate per acre, Langworthy yielded 6 tons 2 cwt. 1 qr. 19 lb. The photograph was taken on 3rd December, and ten days later the foliage was completely destroyed by Irish Blight.

Grafton.—Soil, alluvial loam, fertile; site down to pasture for three years previous to this experiment, cropped for three years before that, and pasture previous nine years; sown with potatoes in July, 1921, but covered by floods on 23rd July, 4 feet of water lying for a week and completely ruining the crop. When dry enough scuffled both ways with rigid tine cultivator, twice harrowed and seed sown again on 11th and 12th August, soil being in excellent condition. Rows 2 ft. 9 in., sets 15 inches apart; sets small; germination very patchy, not 50 per cent. in Factor, Satisfaction, and Arran Chief, and hence these varieties not comparable with others. The growth of haulm was poor in all varieties, due to insufficient rain and injury to the physical condition by the heavy flood rains of winter. The rainfall was low in November and December when most needed, particularly as the evaporation was very rapid, temperatures being abnormally high. Only slight increases were obtained in the trial with manures.

The cropping of this site being so uniform for a great number of years advantage was taken to conduct a number of experiments relating to the seed and method of sowing. Two matters, the subject of controversy among local growers, were made the subject of experiment with Early Manhattan. Medium-sized tubers were cut once longitudinally and the sets planted 15 inches apart, (1) with cut side down, *i.e.*, with eyes pointing up, and (2) with cut side up, *i.e.*, with eyes facing down. The yields obtained were 3 tons 19 cwt. 2 qr. 21 lb. and 3 tons 13 cwt. 1 qr. 7 lb. respectively. There was no difference in germination or apparently in the tops during growth.

A trial to determine the relative productiveness of sets taken from different portions of the tuber showed the "rose" or "seed" end to be superior to the "stem" end. Sets were made by cutting off the stem end, leaving on it two good eyes, and splitting the remainder through the "rose" end. Both plots germinated excellently, and no difference was noticeable in growth. The yields were:—

	t.	c.	q.	lb.	
Rose or seed-end sets	3	10	0	14	per acre.
Stem-end sets	3	3	3	0	,,

Raleigh.—Soil, alluvial, rather low lying; site, bank of Bellinger River; previous crop, Saccaline, and previous to that pasture for twenty years; drills 2 ft. 9 in. apart. Ground ploughed, disced and harrowed, condition of soil at planting rough but moist. Germination of all plots and subsequent growth satisfactory. Haulms 2 ft. 6 in. high, and meeting between the rows. Season favourable, 18·79 inches falling in the growing period, 11·96 inches in the last four weeks. The crop was free from disease and insect attack.

Other Experiments.

Experiments with sets of different sizes planted at different distances apart were conducted at Grafton and Tyndale, with Early Manhattan and Satisfaction, and sown on 12th and 21st August respectively. The seed was carefully graded and the sets planted at 6, 12, 15, and 18 inches apart. While it would seem that planting every 6 inches is very close, it is a method adopted by a large number of local farmers. As well as being responsible for potatoes of small size it is expensive in the large quantity of seed required per acre.

It would appear from these experiments that planting sets close together is not advisable, and that the most economical is the small cut set, weighing not less than ¾ oz. and planted 12 inches apart.

To arrive at the most economical set, the amount of seed taken to plant an acre in each case was deducted from the yield. To the Clarence River

grower, who is dependent on outside sources for his seed and who usually pays twice as much for it as he receives for his product, any saving in seed is of paramount importance. The results of these trials are contained in the third table.

RESULTS of Manurial Trials.

	Dorrigo.	Raleigh.	Condong.	Glenreagh.	Tatham.	Tyndale.	Grafton.
Date Sown	23rd Sept.	28th Sept.	22nd Sept.	8th August.	7th Sept.	21st August.	12th August.
Variety Employed ..	Langworthy.	Satisfaction.	Up-to-date.	Up-to-date.	Early Manhattan.	Early Manhattan.	Early Manhattan.
	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.
Superphosphate 5 cwt.	6 2 1 19	6 7 0 16	7 7 3 12	3 17 3 4	5 19 1 8	2 2 1 18	2 14 0 21
P9, 4 ,, ..	5 16 0 16	7 5 0 0	7 16 1 20	5 6 2 18	6 8 3 12	2 14 0 0	2 16 1 0
P7, 2½ ,, ..	5 15 0 20	5 16 1 0	6 15 0 0	3 17 3 20	6 3 2 12	2 7 0 0	2 10 0 0
M7, 3¼ ,, ..	5 13 0 16	7 7 1 0	7 12 0 16	4 19 1 5	6 12 0 0	2 9 1 0	2 11 2 18
No manure .	5 0 0 18	4 5 0 0	6 11 3 0	3 15 1 20	4 14 0 0	1 18 3 0	2 8 3 14
Superphosphate 2½ cwt. ..	5 0 0 2	6 8 2 8	6 8 3 0	3 17 0 0	5 18 0 10	1 16 0 0	2 8 1 21
Greatest increase due to fertiliser.	1 2 1 1	3 2 1 0	1 4 2 20	1 11 0 26	1 18 0 0	0 15 1 0	0 7 1 14

The mixture P9 consists of superphosphate 10 parts, chloride of potash 3 parts, sulphate of ammonia 3 parts; M7 consists of superphosphate 10 parts, chloride of potash 3 parts; P7 consists of equal parts of superphosphate and bone-dust.

SETS of Different Sizes Planted at Different Distances Apart.

Size of Set.	Distance between sets in rows.	Quantity of seed used per acre.	Grafton.		Tyndale.	
			Early Manhattan.		Satisfaction.	
			Yield per acre.	Yield per acre, less seed used.	Yield per acre.	Yield per acre, less seed used.
	inches.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb	t. c. q. lb.
¾ oz. sets (cut)	6	0 13 2 0	3 3 3 24	2 10 1 24	.	...
	12	0 6 3 0	3 14 3 0	3 8 0 0	.	......
	15	0 5 2 0	2 17 2 0	2 12 0 0	2 5 3 6	2 0 1 6
1½ oz. sets (cut)	6	1 6 2 0	3 3 3 10	1 17 1 10	. .	......
	12	0 13 1 0	2 14 1 0	2 1 0 0	...	....
	15	0 10 3 0	2 11 0 0	2 0 1 0	2 8 1 0	1 17 2 0
	18	0 8 3 0	2 8 3 0	2 0 0 0	....	......
1 oz. sets (whole)	15	0 11 0 0	.. .	....	2 19 1 0	2 8 1 0
1 oz sets (cut)	15	0 11 0 0	3 0 3 0	2 9 3 0	....	.. .
2 oz sets (whole)	15	1 2 0 0		..	2 3 2 0	1 1 2 0

Conclusions.

The behaviour of varieties this season was more or less uniform with previous seasons' experiments. Several new varieties have done sufficiently well to warrant further trial in comparison with standard varieties.

The results from the new fertiliser mixtures, P9 and M7, are somewhat remarkable. P9, applied at the rate of 4 cwt. per acre, supplies 2½ cwt. of superphosphate, ¾ cwt. chloride of potash, and ¾ cwt. sulphate of ammonia. It only differs from M7 in the addition of the sulphate of ammonia. In the seven centres where manurial trials were conducted P9 gave the highest yield in four and the second highest in three, while M7 was twice in the lead and three times second. The only centre where these manures did not outyield all others was at Dorrigo, where 5 cwt. of superphosphate gave the highest return, as it did last year, although only separated by 6¼ cwt. from P9. It would appear, therefore, that the addition of potash is very desirable, and that even higher yields are obtainable by the introduction of nitrogen in the form of sulphate of ammonia. While recommendations cannot be made definitely on the results of one season, trials such as these, covering a variety of soil and climatic conditions, and in which the results are so uniform would seem to be rather conclusive.

The experiments with planting sets of different sizes and at varying distances, and in the treatment and cutting of the set, are worthy of careful consideration.

Careful selection and cutting of the seed, thorough preparation of the soil, and correct methods of planting are the secrets of success in potato-growing.

THE EXPLOSIVE CHARGE TO USE IN CLEARING.

To lay down any hard and fast rule as to what sized charge of explosive will be necessary to blast a stump of a given size in all circumstances is manifestly impossible -the type of stump and the nature and condition of the soil for instance, are both qualifying factors, and the farmer will find actual trials under his particular conditions the best guide. Certain broad principles mentioned under this heading in "Use of Explosives in Blasting Stumps" (by G. R. Boyd, U.S. Department of Agriculture, Circular 191) are nevertheless of interest, and may be of help as a rough working basis. It must be born in mind, however, that gelignite, not dynamite, is the explosive generally used in New South Wales; and as gelignite is slightly the stronger, the figures quoted should be modified a little. Says the publication referred to:—

> It is impossible to give any exact rule for the size of the required charge which will apply to all cases. A rule-of-thumb given by E. D. Strait (U.S. Department of Agriculture, Farmers' Bulletin 974), is as follows: "Roughly the number of pounds of dynamite required to shoot a stump clear of the ground* is the same as the square of the number of feet in the diameter of the stump at the cut off. For example, a 2-feet stump will require 4 lb ; and one of 6 feet in diameter will require 36 lb. Often less will do the work, but occasionally more is required." J. R. Mattern ("Clearing Land of Stumps," Institute of Makers of Explosives, New York) says: "Ordinarily it takes 1 lb. of explosives for each foot in diameter of stump, when the stump is such as a white pine in dry soil, cut 10 years or longer. Green stumps of any kind require more than this -usually about half again as much, sometimes twice as much. A rule for the enormous stumps of the Pacific Coast is to square the diameter of the stump, measured in feet, and use this figure as the number of 1¼ by 8 in. sticks of explosives required. This rule usually over-estimates the amount required for stumps larger than 3 feet in diameter."

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* In actual practice the placing of a charge sufficient to shoot a stump clear of the ground is not economical as the explosion simultaneously of two charges—one to partially lift the stump and one to split it.

Nauru and Ocean Island.

THEIR PHOSPHATE DEPOSITS AND WORKINGS.

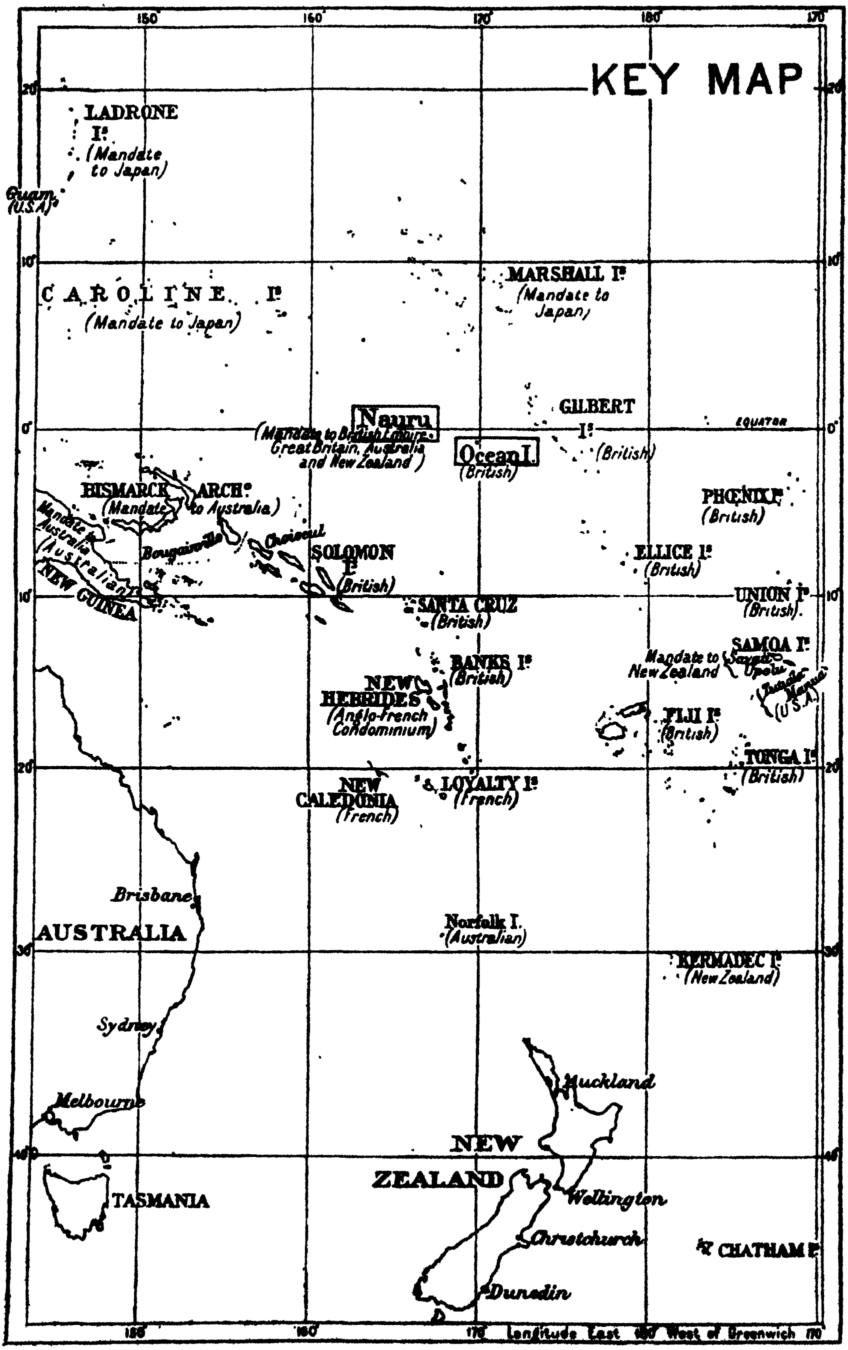
HAROLD B. POPE, Commissioner for Australia.

Now that the Commonwealth is part owner of the phosphate deposits on Nauru and Ocean Island Australians are entitled to know something of the undertaking in which nearly £1,500,000 of their money has been invested.

The Pacific Phosphate Company, from which the phosphate deposits on these islands were purchased, had a record of nearly fifty years in the Pacific, under the successive titles of John T. Arundel and Company, the Pacific Islands Company, and, finally, the Pacific Phosphate Company. Prior to the discovery, in 1900, of the Nauru and Ocean Island phosphate deposits, this company had worked, in different parts of the Pacific, several islands, such as Howland, Baker, Hull, Raine, Bunker, Lady Elliott, &c. In those days operations were carried out on a very limited scale, and the ocean transport was practically all done by sailing vessels with a cargo capacity of from 800 to 1,000 tons each. To-day steamers are being loaded at Nauru and Ocean Island capable of carrying 6,000, 7,000, and even 8,000 tons each. The limited deposits on these "low-grade" islands soon gave out, and, just prior to the discovery of the Nauru and Ocean Island deposits, the company had worked out all the islands on which it had been carrying out operations. So scarce had phosphate in the Pacific become at this stage, and so hopeless did the chances seem of finding any more deposits, that the company, much against the better judgment of its most capable and experienced officers, had been impelled to return to some of its "worked-out" islands. However, the company (by this time the Pacific Islands Company) did not lose hope of one day finding another island, and, to tide it over the lean years, took to trading in copra. Several stations were established in the Gilbert, Ellice, and Marshall Islands, and the old "Archer" was the vessel employed to visit them periodically and collect the copra. In those day, and, in fact, right up to the outbreak of the Great War, Nauru was a German possession, and was included, for administrative purposes, in the Marshall group. For this same reason Ocean Island was included in the Gilbert and Ellice Islands by the British Government. One or two of the company's trading stations were located on Nauru, and it was on the occasion of one of the "Archer's" visits there, about 1897, that the supercargo, being on shore, noticed what appeared to him rather a strange-looking piece of rock, which he picked up and brought to Sydney with him. It was this piece of rock that led to the discovery of the deposits at both islands.

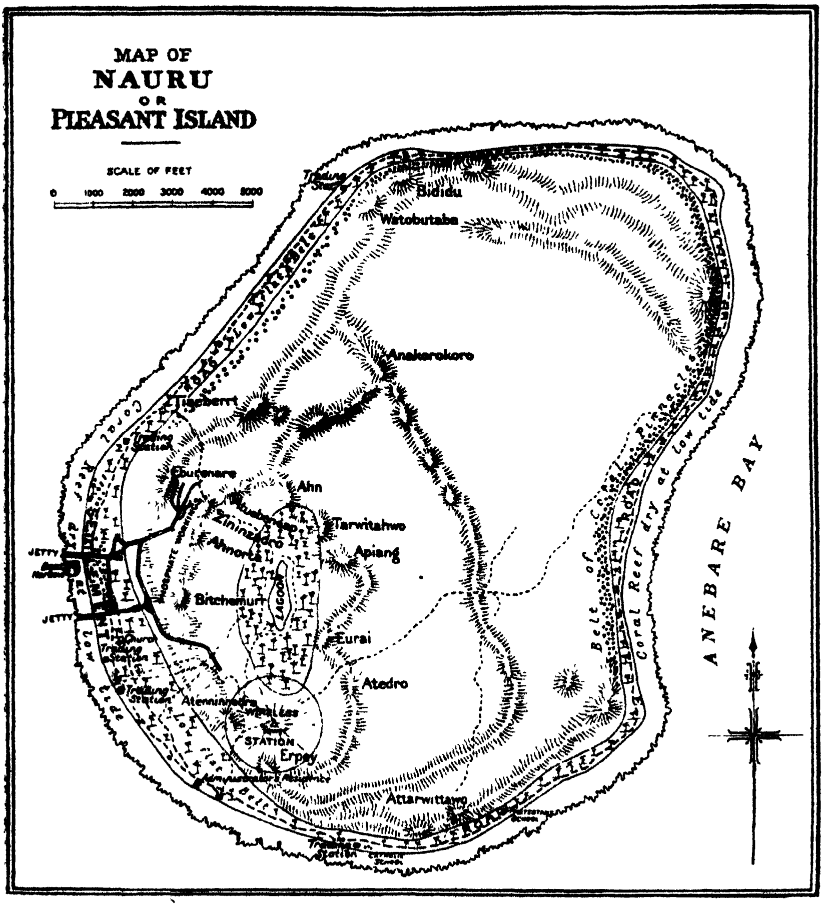
Nauru (Pleasant Island.)

Nauru was discovered by Captain Fearn, in the British ship "Hunter," in 1798, and named Pleasant Island. It continued to be known as Pleasant Island till ninety years later, when, in 1888, the Germans annexed it, and


KEY MAP
LADRONE Is (Mandate to Japan)
Guam (U.S.A.)
CAROLINE Is (Mandate to Japan)
MARSHALL Is (Mandate to Japan)
GILBERT Is (British)
Nauru (Mandate to British Empire: Great Britain, Australia and New Zealand)
Ocean I. (British)
EQUATOR
BISMARCK ARCH° (Mandate to Australia)
Mandate to Australia (Australian) NEW GUINEA
Bougainville
Choiseul
SOLOMON Is (British)
PHŒNIX Is (British)
ELLICE Is (British)
UNION Is (British)
SANTA CRUZ (British)
BANKS Is (British)
SAMOA Is
Mandate to New Zealand
Savaii
Upolu
Tutuila
Manua
(U.S.A.)
NEW HEBRIDES (Anglo-French Condominium)
FIJI Is (British)
TONGA Is (British)
NEW CALEDONIA (French)
LOYALTY Is (French)
Brisbane
AUSTRALIA
Norfolk I. (Australian)
KERMADEC Is (New Zealand)
Sydney
Melbourne
TASMANIA
Auckland
NEW ZEALAND
Wellington
Christchurch
Dunedin
CHATHAM Is
150
160
170
180
170
20°
10°
0°
10°
20°
30°
40°
Longitude East 180 West of Greenwich

reverted to the native name of Nauru, by which it now generally known. Four years earlier, in 1884, the Germans had changed the names of New Britain and New Ireland to Neu Pommern and Neu Mecklenburg. It will be remembered that New Britain and New Ireland were discovered and named by the gallant and intrepid British explorer, Cartaret, when he sailed round the world in 1766-7.

Nauru (for so it will continue to be called here, though it would be gratifying to see its old British name restored) is only 26 miles south of the Equator, lies in latitude 165 degrees 55 minutes east, and is about 2,200 miles from Sydney, or ten days' run by the ordinary cargo steamer. The nearest land is Ocean Island 165 miles to the eastward, and 52 miles south of the Line. Geographically, both Nauru and Ocean Island, which are merely isolated peaks, belong to no particular group of islands. The island has an area of about 12 square miles, and it has been estimated that six-sevenths of this is phosphate bearing. On the lower level, or atoll portion, a well-made



road, measuring about 11 miles, completely encircles it. In addition, there are other roads passing over the high land into the interior, and crossing the island, but, though clearly defined, these are ill-formed and seldom used.

As is usual in the islands of the Pacific, Nauru is surrounded by a flat fringing coral reef, varying in width from 50 to 60 yards. At low-water spring tides the reef is bare, and at high water it is submerged to a depth of 4 feet 6 inches. During neap tides usually 2 to 3 feet of water cover the reef. From the sea side, or outer edge, of the reef, the sea-floor falls rapidly at an angle of about 45 degrees, with the result that at 200 yards out the water is 200 yards or 100 fathoms deep. The Pacific in this vicinity is so deep that both Nauru and Ocean Island must obviously be the tops of two fairly high mountains.

Approaching Nauru from the sea the vivid greens of the island, the white sandy beaches and surf, with the deep, rich blue of the ocean, form a pretty picture. The fringing reef is first encountered. From this a strip of beach rises to a height of about 30 feet above sea-level before merging into what has been mentioned as the atoll portion of the island. This atoll portion, or level belt, commonly called the " flat," varies considerably in width, being over a quarter of a mile wide in some places, whilst in others it does not reach 100 yards. On this part of the island, where the native villages are located, there is no phosphate, and the coconut trees grow in great profusion. Having crossed this strip of land, where, on the western or lee-side, the European settlement (Yangor) is situated, what is generally known as the " cliff " is reached. There the land rises more or less precipitously to an altitude of about 220 feet above sea-level. This elevated portion of the island is composed entirely of phosphate and coral pinnacles. In the interior there is a natural depression, falling almost to sea-level, and terminating in a small and very picturesque lagoon. A good road runs round the margin of this lagoon, which is heavily fringed with tall coconut trees.

The climate is healthy, and malaria unknown. Newcomers, whilst becoming acclimatised, sometimes contract what is locally known as " line-island " fever, a low, mild fever, which invariably spends itself after a few days. Throughout the year the shade temperature only varies from about 85 to 90 degrees Fahrenheit, with considerable humidity.

The native population of Nauru numbers about 1,200. They are of fine physique, intelligent, and bright, and friendly in manner. They have, however, but little desire for work, and, when not engaged on communal duties, occupy their time in fishing, playing, eating, and sleeping. Their food consists mainly of coconuts and fish—the staple native diet throughout the Pacific—but with the money they receive for their phosphate, copra, trees, and fish, they buy from the local store quantities of rice, sugar, biscuits, beef (bullamacow), &c.

How the Deposits were Discovered.

The credit of discovering the phosphate deposits on Nauru and Ocean Islands is due to Mr. Albert F. Ellis, who has been selected by the New Zealand Government as its Commissioner on the British Phosphate Commission—and the distinction could hardly have fallen on one more worthy or more deserving of it. Mr. Ellis has had thirty-five years' experience in the Pacific, and his knowledge of that vast ocean and its myriads of islands is most extensive. He has quite recently written the account of how he made the discovery, which I will give in his own words.

"Hitherto no first hand account of the discovery has appeared in print, and such accounts as have been written contain various inaccuracies. Just prior to 1900 I had been serving as manager of one of the islands of the Pacific Islands Company on the Queensland coast, and had been transferred to the company's Sydney office, where an analytical laboratory had been installed for the purpose of dealing with samples of cargo, &c. My attention was arrested by a large block of rock used for keeping open the door of the laboratory; in some ways it resembled a rare kind of phosphate rock, of which a small deposit had been found in a deep depression on Baker Island, in the Phœnix Group, several years previously. On mentioning the matter to the Company's manager, I was told that it was a lump of petrified wood found by him on Pleasant Island (Nauru) some three years previously, and that one or more geologists had agreed as to its nature. This seemed decisive enough, but somehow, when working in the laboratory, that piece of rock repeatedly attracted my attention, and some three months afterwards the thought occurred, 'Why not test it?' A chip was knocked off, ground up, and tested for phosphate, with such a decided reaction that a complete analysis was made, and the humble door-chock proved to be phosphate rock of the highest quality. Moreover, from its formation, there were evidences that it came from an old and probably extensive deposit; as to the latter the manager was very emphatic.

"The question then arose as to how the deposit could be obtained, and this matter was promptly taken in hand by the Company's head office in London. The position was that a large German Chartered Company held mineral and other rights over the German Caroline and Marshall Islands, north of the Equator, and also over Nauru. On the other hand, the Pacific Islands Company, which was the immediate predecessor of the Pacific Phosphate Company, held numerous coconut properties and trading stations on the German islands which the Chartered Company referred to was particularly desirous of acquiring. Negotiations ensued, with the ultimate result that the Germans acquired the trading stations on their own islands, and the Pacific Islands Company obtained the concession to work Nauru. The Germans also received a certain number of shares in the company, and a royalty per ton on the phosphate exported, so that it was a transaction which proved profitable to them, though not to the extent that it did to the Phosphate Company and to British interests generally."

The shares in the Pacific Phosphate Company which the German Company (the Jaluit Gesellschaft) secured were declared and delivered to the Public Trustee in London immediately after the outbreak of war. They were sold by public auction, and bought by a large English shipping company, thus automatically making the company controlling the Nauru and Ocean Island deposits an entirely British concern.

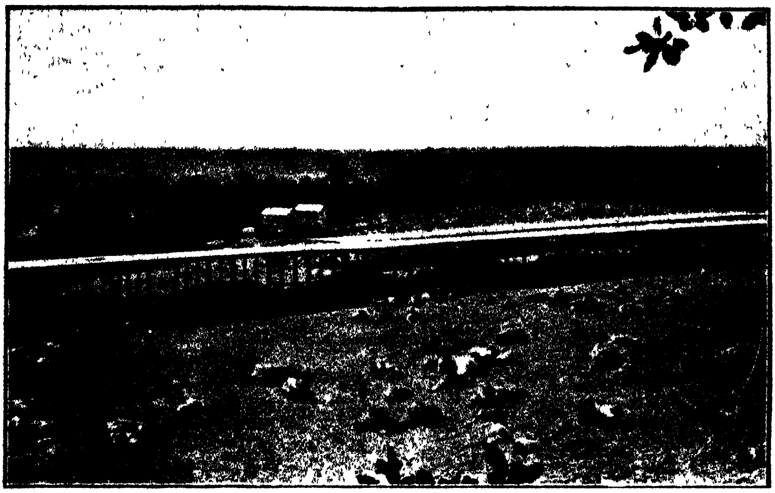
When Mr. Ellis made his discovery it was rightly concluded that, as Ocean Island was in the immediate vicinity of Nauru, and of practically the same formation, similar deposits would, in all probability, be found there. Such proved to be the case, and as Ocean Island was British (though it was not formally annexed and proclaimed a British possession till Captain Tupper, of H.M.S. "Pylades," annexed it in 1901), operations on that island were commenced first.

The Extent of the Deposits.

Quite a number of misleading statements as to the quantities of phosphate on Nauru and Ocean Island have been made, but it can safely be said that, at the present moment, there are on Nauru and Ocean Island not less than 100,000,000 tons of some of the highest grade phosphate known to exist. How much more there might be it is impossible to say, for the comparatively few fields classed as "worked-out" were abandoned, not because the phosphate was exhausted, but because it had become difficult to work, deposited as it is between coral pinnacles. After a depth of from 20 to 30 feet between the pinnacles has been reached it does not pay under present conditions to work that field any further. The deposits on Ocean Island have been estimated by Mr. Ellis, the Commissioner for New Zealand, at probably 30,000,000 tons of available phosphate, but, he adds, this quantity may be much exceeded.

The quality of the phosphate from these islands is particularly high. Throughout their working history (a period extending over twenty-one years) the cargoes shipped from both have consistently averaged from 85 per cent. to 88 per cent. tribasic phosphate of lime. As a matter of fact that portion of the workings on Ocean Island known as the plateau has yielded, for some time past, phosphate averaging as high as 88 per cent. This, it is believed, is without parallel in the history of phosphate mining. The phosphate deposits on the French island of Makatea, near Tahiti, in the Pacific Ocean, are rich, but they fall short of the Nauru and Ocean Island standard. Though the Ocean Island phosphate is slightly higher in quality than the Nauru product, the latter lends itself better to the manufacture of superphosphate, and, generally speaking, is preferred by the "super" manufacturers on that account.

A question often asked, is, "How long will the deposits last?" This, of course, depends upon the rate at which they are worked. The Australian demand for Nauru and Ocean Island phosphate twenty years ago was only 20,000 to 30,000 tons per annum. This year over 200,000 tons are required. It is hoped that the total output from Nauru and Ocean Island will soon reach 500,000 tons per annum, but even if an annual output of 500,000 tons from each island is reached and maintained, it must not be forgotten that there are at least 100,000,000 tons to be removed before the deposits will become exhausted. The Australian farmer, therefore, has no need to be anxious about his supplies of superphosphate. Whatever may happen in less fortunate countries, his supplies are assured for the next four or five generations at any rate.

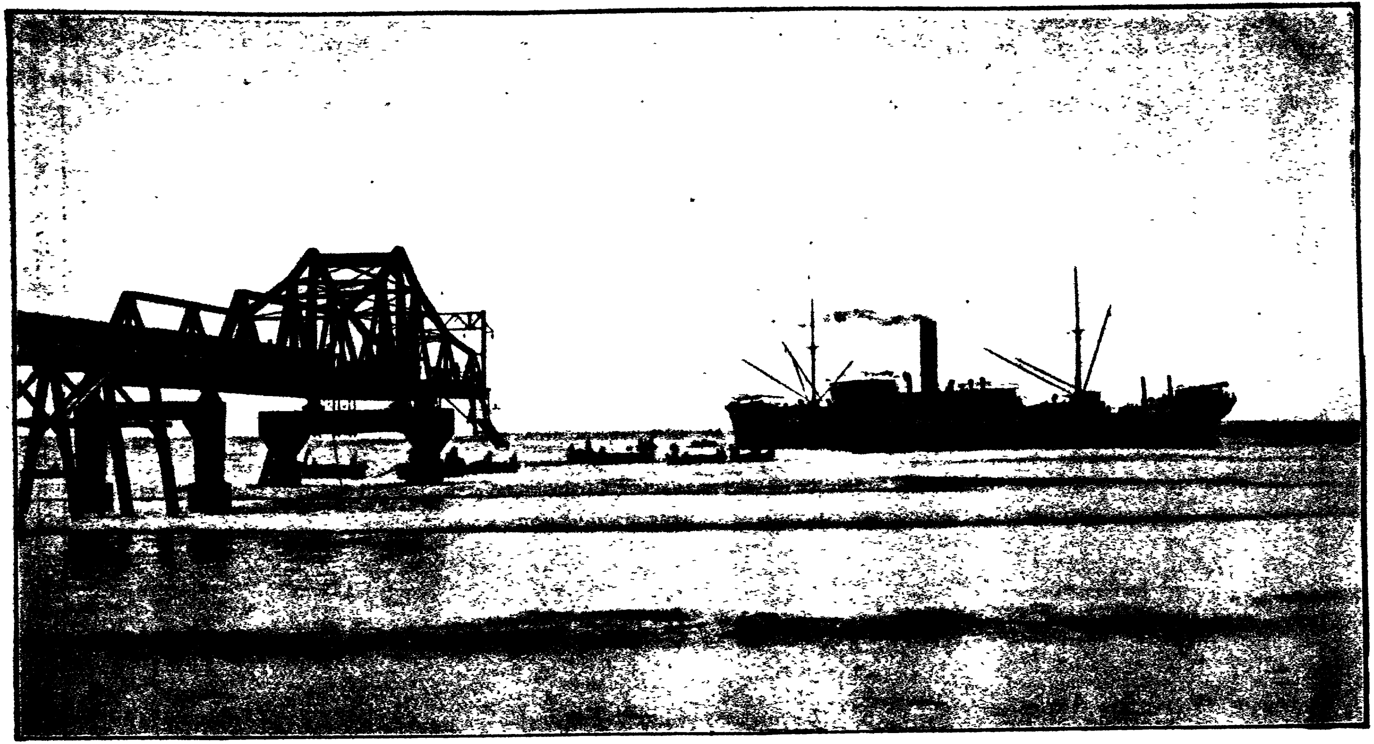


Nauru: Field with overburden removed ready for working.

The peaks of the coral pinnacles can be seen above the level of the deposit. The covered-in area is worked during wet weather

Nauru: Railway Line through part of a "Worked-out" Field.

Coral pinnacles stand up on either side of the railway.



Nauru: A vessel loading 6,000 tons for Australia. (From one jetty over 1,200 tons were shipped to the steamer shown the day this photo was taken.)

How the Deposits were Formed.

There has been considerable conjecture as to how these extensive and wonderfully rich deposits came into existence. What is known as the bird theory is the most popular and generally accepted. And it is in all probability correct, for phosphatised fish bones, shark teeth, &c., are continually being discovered. The writer himself found on Nauru in 1907 a phosphatised egg about the size of a hen's egg. When this egg was broken the "yolk" fell out—a solid pebble of phosphate. The "white," or albumen, was represented by several layers, each as thin as, or thinner than tissue paper. But the original guano, in the form of bird excreta, must have been deposited many thousands of years ago. There is evidence that the islands have been submerged on several occasions. The result is that all impurities have long since been washed away, and practically only the pure phosphate of lime remains. There is no odour or unpleasantness of any kind, and, to the unpractised eye the Nauru and Ocean Island phosphate is no different in appearance from ordinary friable, light-brown soil. Occasionally it takes the form of rock, some of which is as hard as granite, with a surface which will take a polish equal to any marble. Curiously enough, the birds believed to be responsible for these deposits are now extinct, and the islands to-day, with the exception of a few terns, noddies, and frigate birds, are practically birdless.

The British Occupation.

The outbreak of war found the Pacific Phosphate Company controlling the deposits on both islands. On the 4th August, 1914, the white staff on Nauru was about two-thirds British and one-third German. Soon after the commencement of hostilities in Europe, Nauru was placed under martial law, and the British there subjected to all manner of petty indignities till their deportation was ordered, on the 5th September, by the representative of the German Government. They were then given only a few hours to pack and get away by one of the Company's small time-chartered vessels, the Norwegian steamer "Frithjof," which happened to be there. This ship took the British subjects to Ocean Island, where a warm welcome greeted them. The deportees were absorbed into the staff on Ocean Island, where they remained till two months later, when the Commonwealth authorities sent up, by one of the Company's large time-chartered vessels, the "Messina," a detachment of about sixty-six Australian soldiers, under the late Brigadier-General Holmes. From Rabaul, where the "Messina" picked up the soldiers, the vessel proceeded to Ocean Island, where the British deportees, with their wives and children, were taken on board. The next day the voyage was continued to Nauru, when General Holmes was prepared to force a landing if necessary. But though the Germans, with their strong force of armed and trained native constabulary, were about equal in numbers, they wisely attempted no resistance, and were themselves deported to Australia, *viâ* Rabaul, by the "Messina," the following day. Only a few days after the British were re-established in their homes, a Japanese battleship and trooper, with troops on board, arrived to take possession of the island in the same manner as the German Caroline and Marshall Islands, north of the Equator, had already been occupied by that nation.

From this out (November, 1914) Nauru continued to be held and garrisoned by Australian soldiers. It was maintained at the Peace Conference that Australia had occupied Nauru on behalf of the Imperial Government, and that her claims could not be held to nullify others. The Australian Prime Minister insisted, however, that the Commonwealth's just claim must be recognised. On top of this, our friends in the Dominion of New Zealand lodged a claim on the ground of proximity and New Zealand's need of guaranteed supplies of phosphate for future years. After a strenuous fight by Mr. Hughes for the recognition of Australia's claims, an agreement was arrived at by which the three Governments were to participate jointly in the Nauru deposits, and also to incorporate the Ocean Island deposits in the scheme.

The price paid by the three Governments (Britain, Australia, and New Zealand) was £3,500,000 in the proportions of 42 per cent., 42 per cent., and 16 per cent., respectively, and now that the facts have been placed before them, Australians will fully realise what the ownership of more than one-third of the wonderful deposits on these two islands will mean to them and to future generations of Australians. The sum of £3,500,000 was paid, not only for the Pacific Phosphate Company's right, title, and interest, but also for the plant on both islands. It has been calculated that the replacement of the very extensive plants on these islands would take, at present-day prices, a considerable proportion of the sum paid as the purchase price.

Under the terms of the Nauru Island Agreement Act, 1919, each of the countries named therein is entitled to an allotment of the following proportion of the phosphate produced in any one year, viz.:—

United Kingdom	42 per cent.
Australia	42 per cent.
New Zealand	16 per cent.

These allotments are for home consumption for agricultural purposes in the country of allotment, and not for export. The basis of allotment is to be readjusted every five years, in accordance with the actual requirements of each country. If in any one year one of the three countries does not require portion of its allotment, the other two countries are entitled, so far as their requirements for home consumption extend, to have that portion allotted among themselves in the proportions to which they are entitled as above. And here it might be mentioned that owing to Great Britain not requiring her full quota this year, Australia, instead of being allotted 168,000 tons, will receive a little over 200,000 tons out of the total quantity of 400,000 tons which, it is anticipated, will be shipped. Up to the present the best year's figures are those for 1913, when a total quantity of practically 350,000 tons was loaded.

The business is now vested in a Board of Commissioners, comprising three members—one appointed by each Government—the writer being appointed by the Commonwealth Government, Mr. A. R. Dickinson by the

British Government, and Mr. A. F. Ellis by the New Zealand Government. The Commission took over the business on the 1st July, 1920, and the central office of management is at 465 Collins-street, Melbourne.

Progress under Government Ownership.

The Commissioners assumed control on the 1st July, 1920, and during their first year, which ended on the 30th June, 1921, a total quantity of 364,424 tons was despatched from the two islands. It will be seen that in the first year the total shipments improved by 25,463 tons. Later information shows that the total quantity shipped for the twelve months ended 31st December, 1921, amounted to the record figure of 394,051 tons. This is 55,090 tons more than the Pacific Phosphate Company's best year. At a glance the comparisons are therefore:—

Pacific Phosphate Company's record year (ended 31st December, 1913)—338,961 tons.

British Phosphate Commission's first year (1st July, 1920, to 30th June, 1921)—364,424 tons.

British Phosphate Commission's twelve months (ended 31st December, 1921)—394,051 tons.

The shipments for the last year under the Pacific Phosphate Company—1st July, 1919, to 30th June, 1920—amounted to 225,524 tons.

It was expected that the output for 1921 would reach 400,000 tons, but owing to bad weather prevailing during part of December (November-February usually constitutes the "westerly" or bad weather season) our total shipments (394,051 tons) for the year were just a little short of that quantity. The increased shipments have been made with practically the same plant, and without any increase of staff, white or coloured, on either island.

The results for the first eighteen months under the new control may be summarised as follows:—

The total quantity shipped during the eighteen months ended 31st December, 1921, was 554,656 tons, which was distributed in the following manner:—

	Tons.
To Australia	357,496
To United Kingdom	32,300
To New Zealand	29,750
To other countries	135,110

As 1 ton of phosphate makes nearly 2 tons of superphosphate, after being treated and mixed with sulphuric acid, this means that something like 715,000 tons of superphosphate, made from Nauru and Ocean Island phosphate, were manufactured and used in Australia during the comparatively brief period of eighteen months. Press reports indicate that this season's wheat harvest in Australia has proved a particularly good one. It is the Commonwealth's share in Nauru and Ocean Island resulting in increasingly large shipments of high-grade phosphate pouring into this country from those islands which, in a large measure, has made this possible.

Working Operations.

As already stated, the phosphate deposits are situated in the central, elevated, and uninhabited portion of the island. Before commencing to work a field, the trees are valued, paid for, and cut down. The undergrowth is then collected into heaps, left a few days, and then burnt. After this the overburden, consisting of coarse grass, and the top 2 or 3 inches of weather-stained phosphate, is removed. The field is then ready for working. Light 2-foot gauge railways, branching off the main line, are run into the new field. The phosphate trucks, which are the patent side-tipping 1-ton capacity type, are pushed on to this line, and the Chinese coolies, each using two carry-baskets, proceed to fill them. The coolies are divided into two gangs; one digging out the phosphate and filling the baskets, the other carrying them. In the phosphate fields and on the upper levels steam locomotives are used. These ply along the main lines and collect from the fields on each side "rakes" of trucks as they become ready. The trains are then taken to the dryer plants, where the trucks are tipped from a gallery into the top of the "wet" bins. Through doors in the floor of these bins the phosphate gravitates to the rock crushers (which crush any pieces of rock to, say the size of a walnut), and thence into the dryers.

The dryers are large rotary cylinders about 60 feet long, tapering slightly from the furnace end, and having the inside surface set with vanes. As the cylinder revolves these vanes turn the phosphate over and over, completely exposing every particle to the terrific heat, and at the same time precipitating it towards the outlet end. Having travelled along the whole length of the cylinder, the phosphate, by this time so hot that it cannot be touched with the hand, falls through an aperture on a steel band conveyor, by which it is carried to and delivered into the tops of the large storage bins, where it is ready for shipment.

The trains on the "flat" (the atoll portion of the island) are electric, and are run under the concrete floors of the storage bins, which are fitted at frequent intervals with hopper doors. On a truck coming down under one of these doors, a lever is pulled, and it is filled in a few seconds. As soon as a train load is ready, the electric locomotive hauls it to whichever jetty is shipping. At the jetty end there is a hopper holding about 2½ tons, or one lighter load, into which the phosphate is tipped. On a staging erected under the jetty decking a "boy" stands operating a lever. As soon as the lighter is in position under the shoot this lever is pulled, and a door at the bottom of the hopper is opened, through which the phosphate falls into the shoot. Attached to the end of the shoot is a flexible nozzle, by means of which the boys in the lighter below direct the phosphate into the four large baskets, which each boat carries. Some, however, carry six baskets. A four-basket boat when loaded holds about 2½ tons of phosphate, and a six-basket boat about half as much again. Motor launches then tow the lighters to the ship's side. The baskets are hauled up, one at a time, by the ship's tackle, and swung inboard over the hatch, which is closed, except for a narrow opening in the centre, across which a tipping block is placed. Stationed here are two boys, whose duty it is to steady the swaying basket in order that, when lowered, it may fall squarely on the block. This done, it immediately capsizes, emptying its contents into the opening mentioned. In this manner 1,300 tons have been loaded in one day to a single ship, and, working two shifts, as much as 2,000 tons a day has been loaded by one vessel. At night electric flood-lights are used. The most suitable ships to load are those with no 'tween decks where no trimming is required.

The modern steel cantilever jetties have an overhang reaching out beyond the outer edge of the reef to a distance of 70 feet. On the edge of the reef the water is usually broken, and the advantage afforded to the lighters in being able to remain in the unbroken and comparatively still water, while the baskets are being filled, is enormous. The end of each jetty is furnished with a steam or electric winch and a good, strong derrick. When a ship is discharging her inward cargo of stores, &c., the goods are lowered over the side into the boats, which are later on used for loading. The boats when filled are towed to the jetty end, where the contents are hauled up, placed on trucks, and run away to the various stores.

The moorings to which the ships make fast are the largest and deepest in the world, and a great deal of arduous and dangerous work is necessitated in the laying of them. They are laid by a New Zealander—Mr. G. W. W. Cozens, of Auckland—who is an expert in these matters. The main buoy of each set of moorings is about a couple of ship's lengths from the shore, with the outer anchor lying in about 200 fathoms of water—nearly a quarter of a mile deep. The moorings are very efficient, being easily approached and made fast to and readily "slipped" if, in squally weather, it is necessary for a vessel to put hurriedly to sea. The amount that these excellent moorings have contributed towards the success of the loading operations at both islands can hardly be over-estimated.

Even with the present fine equipment and jetties, however, loading has to be discontinued when the surf becomes heavy, and in order to make themselves as independent as possible of the weather, the Commissioners now contemplate the installation at Nauru of a cantilever or gantry capable of loading a 7,000 or 8,000 ton vessel in twenty-four hours. When the Nauru cantilever or gantry has proved itself a success a similar plant will be installed at Ocean Island. Though the initial cost of the proposed erection at Nauru will be considerable, the savings effected by its successful operation will more than compensate for the very large outlay involved. A vessel capable of lifting, say, 8,000 tons would be loaded and despatched in twenty-four hours instead of taking a week or more to complete, as at present. Cheaper freights will thus be procurable. The labour of the "boys" employed in the lighters and launches will be saved. The boat repairing, basket repairing, and basket making gangs will be considerably reduced, if not entirely eliminated, and it is probable that the ship and jetty gangs will also be capable of reduction. The labour of all these men will then become available for raising phosphate, and the yearly output of Nauru alone (which was 241,440 tons in 1921) should considerably increase.

Ocean Island.

Ocean Island, the native name of which is Banaba, was discovered by the British ship "Ocean" in 1804. For many years past it has been the seat of government for the Crown Colony of the Gilbert and Ellice Islands. Though it is only about one-third the size of Nauru, its phosphate deposits, as already stated, are wonderfully rich. The shape of the island has frequently been compared to that of a pearl shell, the one large indentation being called Home Bay. Like Nauru, Ocean Island has the usual fringing reef, but once that is crossed the land rises more or less abruptly to an altitude of about 265 feet above sea-level. There are two white settlements—Uma (Ooma) and Tabwewa (Tapiwa).

Finally, there can be no doubt that in owning more than one-third of the deposits on Nauru and Ocean Island, Australia has a wonderful asset. The demand for phosphate is rapidly increasing all over the world, and it is gratifying to know that an agricultural country like ours is now assured of its phosphate requirements, however quickly the demand may rise, for a great many years to come.

POISON BAITS FOR CUTWORMS.

ONE of the oldest and most generally used methods of controlling cutworms, according to the South African *Journal of the Department of Agriculture*, is the broadcasting on the land of poisoned bait made by poisoning wheat bran, cut-up green stuff, or other similar substance, with arsenic, and adding sugar, treacle, salt, chopped citrus fruit, or other things supposed to attract the worms. Very little truly scientific work has been done to determine whether cutworms actually respond to these supposedly attractive substances. Incomplete experiments at Cedara, Natal, to determine the reaction to odour of various cutworms and army worms indicate that the sense of smell is very poorly developed in these larvæ. Starved cutworms, for instance, can apparently detect the odour of their crushed food plant only when it is but a few inches away from them. The discovery of a bait which will attract cutworms from other available food does not appear very hopeful, although work with this object in view has not been abandoned.

THE FERTILISER REQUIREMENTS OF LUCERNE.

LUCERNE can no more thrive in the absence of an adequacy of phosphates than wheat, or any other of our crops, and, with a few exceptions, we know our soils to be generally poorly stocked with this constituent. Phosphatic dressings are therefore essential to numerous and heavy cuts; they may, too, be said to be essential to quality in these cuts. Hence, I recommend in the first place dressings of 2 cwt. to 3 cwt. at seeding time, and subsequent annual dressings of 1 cwt. applied towards the end of winter, and prior to the first summer irrigation. It should be added, of course, that in those soils in which phosphates are already abundantly present in soil or subsoil, there is no need to waste useful money in useless dressings.—A. J. PERKINS, Director of Agriculture, in the *Journal* of the South Australian Department of Agriculture.

Field Experiments with Wheat, 1921.

WAGGA EXPERIMENT FARM.

H. ROSS, Manager.

[The Experiments Supervision Committee, under whose control these experiments are being conducted, wish to draw the attention of farmers to the fact that final conclusions cannot be drawn from these trials, but in some cases the results warrant the drawing of interim conclusions which should be of value.]

EXPERIMENTS were conducted on this farm in the season 1921 on heavy red loam of granite origin, typical of the majority of the Riverina wheat soils. A "three-course" rotation, including Skinless barley (cut green for ensilage) and fallow, is adopted in connection with these trials.

The rainfall was as follows:—January, 72 points; February, 81; March, 221; April 330; May, 199; June, 214; July, 85; August, 209; September, 312; October, 145; November, 10; December, 168.

The weather during April and May was satisfactory from a seeding point of view, and good germination was obtained throughout all the experiments. Splendid growing weather prevailed until early in November, when hot, dry weather was experienced, causing in some instances a premature ripening of the grain.

Wheat Variety Trial for Grain.

The seed in both the early-sown and midseason-sown sections was treated with bluestone and limewater prior to sowing. The plots were each one-tenth of an acre in area. The early-sown section was planted on 27th April at the rate of 40 lb. per acre, the midseason-sown section on 16th May at the rate of 48 lb. per acre, superphosphate being applied to each plot at the rate of 56 lb. per acre. The seed of Onas and Roseworthy was received too late for the early sowing, and could only be included in the midseason sowing.

The germination in both sections was good, and the growth throughout very satisfactory. None of the varieties were affected to any extent with rust, and no damage was done by late frosts The early-sown section was harvested on 29th November and the midseason section on 8th December. Following are brief notes on some varieties of recent origin:—

Forelock.—A late-maturing, bearded variety; profuse stooler. The straw was somewhat tall, but not inclined to lodge. Medium-sized, erect white ear; white grain of medium size, and not inclined to shell.

Waratah.—A moderate stooling variety, matured a few days later than Hard Federation. The straw was of medium height and semi-solid. The ear light-brown, erect, of medium length, with long tip awns. Grain of medium size, dark yellow, slightly elongated, and not inclined to shell.

Riverina.—A sparse stooler of medium height, maturing about a week earlier than Hard Federation. Ear white and erect with a small tip awn Grain yellow, of good size, and not inclined to shell.

Early Bird.—A very early-maturing variety; a sparse stooler, straw of medium height and very weak. Ear erect, white and tapering, with a few short tip awns. Grain yellow, of medium size, and not inclined to shell.

Aussie.—An early-maturing variety; a rather sparse stooler, straw of medium height and semi-solid. Ear drooping, white, awnless, and tapering. Grain of medium size, yellow, and does not shell.

Stamina.—An early-maturing variety, moderate stooler, medium height. Ear drooping, very light brown, awnless. Grain very similar to that of Federation.

Bald-knob.—Matures about three days later than Hard Federation; sparse stooler, short straw. Ear erect, white, awnless; tips of ears were not well filled. Grain of medium size, light yellow, and does not shell.

Wandilla.—A medium stooling variety, matures about six days later than Hard Federation. Medium height, ear drooping, white, awnless, long and tapering. Grain yellow, of medium size, and does not shell.

Ghurka.—A short-growing, early-maturing variety; sparse stooler. Ears brown, erect, and tip-awned. Grain slightly elongated, horny, yellow, of good size, and not inclined to shell.

Union.—Matures about ten days after Hard Federation, medium height. Ear brown, erect, awnless; grain pale yellow, and does not shell.

Wagga No. 13.—Matures about the same time as Hard Federation, medium height. Ear erect, white and awnless; grain yellow, and not inclined to shell.

Wagga No. 49.—Matures about three days earlier than Hard Federation; straw a little taller than Hard Federation. Ear white, slightly drooping, with a very small tip awn; grain yellow, and does not shell.

YIELDS in Wheat Variety Trials for Grain.

Early-sown Section			Midseason-sown Section		
Variety.	Yield per acre.		Variety.	Yield per acre.	
	bus.	lb.		bus.	lb.
Gallipoli	32	13	Wandilla	28	4
Wandilla	31	45	Aussie	25	40
Aussie	29	50	Onas	23	28
Gresley	29	23	Hard Federation (check)	22	50
Hard Federation (check)	28	10	Gallipoli	22	50
Minister	28	10	Union	22	10
Forelock	27	31	Ghurka	21	29
Bald Knob	27	1	Wagga No. 13	21	21
Union	26	45	Canberra	21	19
Wagga No. 13	26	32	Forelock	20	59
Canberra	26	15	Bald Knob	20	58
Stamina	25	11	Gresley	20	21
Waratah	24	45	Waratah	20	16
Wagga No. 41	23	36	Roseworthy	20	12
Riverina	23	11	Stamina	20	8
Clarendon	22	44	Riverina	19	46
Ghurka	20	32	Clarendon	19	1
Early Bird	18	25	Wagga No. 49	18	57
			Minister	18	50
			Early Bird	18	19

Wheat Variety Trial for Hay.

The early-sown section of this experiment was planted on 26th April at the rate of 45 lb. per acre, and the midseason-sown section on 10th May at the rate of 55 lb. per acre, superphosphate being applied to each plot at the rate of ½ cwt. per acre. The germination right throughout the plots was satisfactory and the growth excellent. None of the varieties were affected to any extent by rust. Yandilla King, Marshall's No. 3, Warden, Bomen, Firbank, Improved Steinwedel, Riverina, Early Bird, and Clarendon were harvested on 20th October. Zealand, Zealand Blue, and Union were harvested on 3rd November. The weather during the haymaking was exceptionally fine and an excellent sample of hay was obtained. The plots were each one-tenth of an acre.

YIELDS of Variety Trials for Hay.

Early-sown Section.				Midseason-sown Section.			
Variety.	Yield per Acre.			Variety.	Yield per Acre.		
	t.	c.	q.		t.	c.	q.
Warden	2	16	0	Union . .	2	7	2
Zealand (check)	2	10	3	*Zealand Blue	2	5	0
Bomen	2	5	1	Riverina	2	4	1
Yandilla King	1	19	3	Improved Steinwedal	2	0	3
Marshall's No. 3	1	17	2	Firbank (check)	2	0	0
				Clarendon .	1	19	1
				Early Bird.. ..	1	13	2

* Seed arrived too late for inclusion in the early-sown section.

Warden has given the highest yield of hay in the early-sown section. It has the advantage that it reaches maturity almost a week earlier than Zealand, which it excels in quality. Union, a variety of recent origin, gave the highest yield in the midseason-sown section. This crop was only of medium height, but this variety stooled exceptionally well and a dense bulk of hay was produced.

Hay Fertiliser Trial.

The object of this experiment is to determine what is the most profitable quantity of superphosphate to apply to a hay crop.

Zealand wheat was sown on 26th April at the rate of 45 lb. per acre. Superphosphate was applied at 56 lb., 112 lb., 168 lb., and 224 lb. per acre, unmanured check plots being sown every third plot. The plots were each one-tenth of an acre in area.

The germination throughout the experiment was very satisfactory and excellent growth was made on all the plots. The season was ideal as far as hay-growing was concerned, and full benefit was derived from the fertiliser applied. At all stages of the growth a progressive difference was distinctly noticeable in favour of the heavier dressings of fertiliser. The crop was harvested on 2nd November.

YIELDS and comparative costs in Hay Fertiliser Trial

Treatments in order of merit.	Yield per acre.	Increase due to treatment.	Value of Increase.	Cost of Increase.	Net gain.
	t. c. q.	c. t.	£ s. d.	s. d.	£ s. d.
224 lb. superphosphate per acre ...	3 2 2	19 1	5 15 6	14 0	5 1 6
112 ,, ,, ,, ...	3 0 3	17 2	5 5 0	7 0	4 18 0
168 ,, ,, ,, ...	3 1 0	17 3	5 6 6	10 6	4 16 0
56 ,, ,, ,, ...	2 14 2	11 1	3 7 6	3 6	3 4 0
No manure	2 3 1	.....	.....	.....	......

Chaff was valued at £6, and superphosphate at £7. The highest net gain was obtained by an application of 2 cwt. superphosphate, but it would be advisable to keep in mind that more rain was experienced this season than is usual in this district.

Mixed Hay Trial.

The object of this experiment is to determine the most suitable combination of wheat and oats to grow for hay in this district. Zealand wheat alone was used as a check, and sown every third plot. The check plots were sown at the rate of 45 lb. per acre, and the mixtures at the rate of 80 lb. per acre (40 lb. of each). The experiment was planted on 26th April, superphosphate being applied at the rate of ½ cwt. per acre.

The germination throughout the experiment was very satisfactory, and the growth excellent. A good appearance was presented by the Zealand and Huguenot, Zealand and Algerian. and Zealand and Kelsall plots, but the other plots sown with mixtures presented an uneven appearance. The crop was harvested on 2nd November.

YIELDS and comparative values in mixed hay trial.

Mixtures in order of merit	Yield per acre.	Increase.	Value of increase.	Cost of increase.	Net gain.
	t. c. q.	c. q.	£ s. d.	s. d.	£ s. d.
Zealand wheat & Algerian oats ...	3 10 0	11 1	3 7 6	3 6	3 4 0
Zealand wheat & Quandong oats .	3 3 0	4 1	1 5 6	3 6	1 2 0
Zealand wheat & Kelsall oats ...	3 3 0	4 1	1 5 6	3 6	1 2 0
Zealand wheat & Sunrise oats ...	3 2 1	3 2	1 1 0	3 6	0 17 6
Zealand wheat & Huguenot wheat	3 1 1	2 2	0 15 0	4 8	0 10 4
Zealand wheat alone (*check*) ...	2 18 3	....	....	....	... .

Seed oats was valued at 4s. per bushel; seed wheat at 8s. per bushel; chaff at 6s. per bushel.

Oats Variety Trial for Grain

This experiment was sown on 28th April at the rate of 40 lb. of seed per acre, superphosphate being applied to each plot at the rate of ½ cwt. per acre. The germination throughout was excellent and all the plots made very good growth. Lachlan and Yarran were very badly affected by rust on the flag and stem. The yield of Lachlan was also materially reduced on account of most of the stems breaking off at about the second joint just prior to harvesting. The crop was harvested on 2nd November.

Variety.	Yield per acre.		Variety.	Yield per acre.	
	bus.	lb.		bus.	lb.
Algerian (*check*)	48	35	Kelsall ...	39	6
Calcutta ..	46	15	Quandong ...	38	36
Fulghum ...	43	22	Sunrise ..	37	37
Yarran ..	42	36	Mulga ...	33	25
Lachlan ...	41	4			

Oat Variety Trial for Hay.

This experiment was sown on 28th April at the rate of 45 lb. of seed per acre. The germination was excellent, and all the varieties made very good growth. Following are brief notes on the varieties:—

Algerian.—Stooled profusely; an excellent crop.

Yarran.—A moderate stooler, excellent colour. Matured a few days earlier than Algerian. Badly affected by rust on flag and stem.

Lachlan.—Matured a few days earlier than Algerian, moderate stooler, stems somewhat coarse, badly affected with rust on flag and stem.

Quandong.—A sparse stooler, matured a few days earlier than Yarran, but not quite as early as Mulga.

Mulga.—An early maturing variety: sparse stooler.

Kelsall.—A very early maturing variety; a rather sparse stooler, but abundant foliage. On account of its earliness and its bulk of succulent foliage, this should be an ideal variety to grow for green fodder in this district. It is even earlier than Skinless barley.

Sunrise.—Early maturing, sparse stooler, excellent colour.

Calcutta.—Good stooling, late-maturing variety; very similar in every respect to Algerian.

Fulghum.—Good stooling. Matures about a fortnight earlier than Algerian. Stems a little coarse.

Variety.	Yield per acre			Variety	Yield per acre.		
	t.	c.	q.		t.	c.	q.
Algerian ..	3	5	2	Quandong ..	2	11	1
Calcutta ..	3	3	0	Kelsall ..	2	10	0
Fulghum ...	3	1	3	Lachlan ..	2	6	1
Yarran ..	2	18	1	Sunrise .	2	5	0
Mulga	2	15	1				

Malting Barley Variety Trial.

This experiment was planted on 13th May at the rate of 42 lb. of seed per acre, superphosphate being applied to each plot at the rate of ½-cwt. per acre.

The germination throughout the plots was excellent and very good growth was made by all the plots The experiment was harvested on 22nd November with a combined harvester. The yields were as follows:—

Variety.	Yield per acre	Variety.	Yield per acre.
	bus lb.		bus. lb.
Abed Binder ...	41 18	Pryor	37 37
Golden Grain ...	39 0	Mackie's Chevalier	36 11
Kinver (*check*) ..	38 47	Goldthorpe ...	34 27

Feed Barley Variety Trial.

This experiment was planted on 12th May at the rate of 42 lb. of seed per acre, superphosphate being applied to each plot at the rate of ½-cwt. per acre. The germination and growth were very satisfactory.

The variety O.A.C. 21 is not at all suitable for this district. Before the ears were properly ripe a large percentage of them had broken off and fallen to the ground, as also happened last season. Barley No. 24 is also unsuitable, since it is a very short growing variety and has consistently given very low yields. The crop was harvested in November with a combined harvester. The yields were as follows:—

Variety	Yield per acre.	Variety.	Yield per acre
	bus. lb.		bus. lb.
Chilian .	47 15	Barley No. 24 ...	20 14
Trabut	43 30	O.A.C. 21	12 8
Cape (*check*)	40 28		

ANALYSIS IN RELATION TO FOOD VALUE OF PASTURE.

THE difficulty of determining the feeding value of pasture by means of chemical analysis (according to Professor Somerville in a presidential address before the British Association for the Advancement of Science) was experienced in a marked degree by Hall and Russell, who thus express themselves: "The only general conclusion one can draw is that the method of food analysis as ordinarily practised gives no measure of the feeding value of such material as grass. It fails to reveal anything to correspond to the very marked differences in habit of fattening and non-fattening grasses, and none of the results can be interpreted so as to show which of the grasses were poor and which valuable food. Although the difference in feeding value was known to be great, the differences revealed by the ordinary methods of chemical analysis were very small. The ordinary methods are clearly inadequate for dealing with pasture grasses. It would, therefore, appear that if further attempts are to be made with a view to differentiation between the various pasture plants in respect of nutritive value, resort will have to be had to the digestive tract of animals."

Farmers' Experiment Plots.

MAIZE EXPERIMENTS, 1921–22.

Western District.

H. BARTLETT, Inspector of Agriculture.

MR. E. J. ALLEN, of Grega, co-operated with the Department of Agriculture in conducting a maize variety trial during the past season. The land, which had grown a wheaten hay crop, with no manure in 1920, was ploughed with mouldboard plough on 19th July, harrowed on 26th July; ploughed, harrowed, and rolled during September, sown on 11th October, and scarified 30th October and 30th November. The seed was sown in drills 6 feet apart, three grains every 3 feet in the drills, and superphosphate was applied at 56 lb. per acre.

The following are the rainfall figures:—

1921	July ...	198 points.	1922	January ...	210 points.
	August ..	210 ,,		February	63 ,,
	September	152 ,,		March ...	63 ,,
	October ...	128 ,,			——
	November	200 ,,		Total ..	1,733 ,,
	December	537 ,,			

The yields were as follows:—

	bus.	lb.		bus.	lb.
Funk's Yellow Dent ...	35	20	Wellingrove	29	4
U.S. 133 .. .	34	20	Morrisona	26	40
Iowa Silvermine ...	33	15	Reliance	22	11
Leggett's Pride ...	33	4	North West Dent ...	17	0
Golden Superb ..	29	7			

These results were obtained during what was practically a normal season for the Molong district, excepting for dry conditions during February and March—the time when the cobs were ripening. The thorough preparation of the soil and subsequent scarifyings conserved sufficient moisture for the use of the crops during the dry period mentioned, enabling the varieties to mature well and to fill the cobs with plump grain. Molong is not a "maize district," but it is a district which lends itself to mixed farming—wheat, live stock, and fodder crops—and maize is receiving increased attention, the experiment plots and field crops demonstrating that, by growing suitable varieties and adopting correct cultural methods, average crops of 30 bushels per acre of maize may be relied upon. The grain is most profitably used on the farm for the feeding of horses and pigs, but any surplus would find a ready market in the country towns.

Mr. Allen is a consistent grower of maize, planting each year an area of 20 to 30 acres. He follows the practice of spacing the drills 6 feet apart. The varieties grown seldom attain a height of over 6 feet, and he is able to use the two-horse springtooth cultivator throughout the growth of the crop, which is of considerable advantage where stink grass is troublesome during November and December. Although the wide spacing may reduce the yields, the soil, when cleared of stalks, is easily prepared for the succeeding wheat crop, is clean and well sweetened, and still retains a reserve of moisture.

Of the varieties, U.S. 133 is most in demand. The stalk is short, growing to about 4 feet, but it is noted for producing a well-filled small cob to every stalk.

Iowa Silvermine (white grain) and Funk's Yellow Dent have also proved themselves, taking about three weeks longer to reach maturity than U.S. 133.

THE UNITED STATES OUTLAY ON PROGRESSIVE AGRICULTURE.

ACCORDING to the Year Book of the United States Department of Agriculture for 1920, the Department's estimates of expenditure for the year ending 30th June, 1922, aggregate nearly 42 million dollars, an increase of 10 million dollars over the appropriation for the previous year.

This huge increase is taking place, notwithstanding a substantial reduction in the commercial value of the primary produce of the States. The farm output of the country in the year 1920, produced at an abnormally high cost, was actually worth 3,000 million dollars less than the smaller crop of 1919, and 1,000 million dollars less than the still smaller crop of 1918.

The American evidently considers that a falling market is the occasion for increased activity on behalf of his primary industries, and strange to say, in the face of the reduction in value (not in quantity) of his produce, actually contemplates the erection of new buildings, the increase of the staff, and the improvement of the equipment of the whole vast service.

THE VALUE OF COLD STORAGE.

THE Department of Agriculture in the United States has been engaged in extensive research regarding the wholesomeness and palatability of foodstuffs that have been in cold storage for various periods, and according to a recent leaflet, issued by the Bureau of Markets, has found that "poultry, meats, fish, butter, eggs, and some other products, if they are received in good condition and are properly stored, can be held from nine to twelve months without appreciable loss in flavour, and for much longer periods without loss in food value or general wholesomeness."

The length of time that eggs can be kept in a properly operated cold storage depends mainly on their condition when they enter. Eggs laid during cool weather keep best and longest.

The leaflet remarks that the concentration of population in urban areas has necessitated a like concentration of foodstuffs, and the storing of perishable foodstuffs under refrigeration probably possesses greater possibilities of future development than any other method. In 1887, as nearly as can be estimated there were less than 3,000,000 cubic feet of cold storage in the city of Chicago; to-day the space approximates 60,000,000 cubic feet. and other American cities correspond.

Oat Variety Trials, 1921.

Cowra Experiment Farm.

C. McCAULEY, Experimentalist.

The Experiments Supervision Committee, under whose control these experiments are being conducted, wish to draw the attention of farmers to the fact that final conclusions cannot be drawn from the results, but in some cases the results warrant the drawing of interim conclusions which should be of value.

THESE trials, the aim of which was to determine the most suitable variety of oats for grain for the Cowra district, and the most suitable time to plant such varieties, consisted of two sections, namely, early and late plantings.

The Early Planting.

The land on which the early-planted section was sown (C block) was cropped with wheat during 1920, ploughed during April, 1921, disc-cultivated on 27th April, 1921, and spring-tooth cultivated on 1st June, 1921. The soil varies from sandy to clay loam. Continued wet weather during May delayed the sowing of the experiment until 2nd June, 1921, when the seed was sown at the rate of 40 lb. per acre, with superphosphate at the rate of 60 lb. per acre. Owing to the ideal weather conditions experienced during June and early July the plots made rapid growth. Sunrise, Lachlan, and Mulga made the best early growths; Quandong was backward. The dry frosty weather which set in during the latter end of July and early August caused a check to the growth of the plants, but they made a good recovery as the result of mild weather experienced during the latter end of August and September. Hot dry weather set in during October, and this caused some of the varieties, notably Algerian, Lachlan, Sunrise, and Mulga, which produced a pinched sample of grain, to ripen prematurely. The other varieties produced an excellent sample. All plots were harrowed on 15th July, 1921.

The rainfall during the growing period was as follows:—

June ...	249 points ...	6 wet days.	October..	126 points ...	4 wet days.
July ...	183 ,, ...	5 ,,	Nov. ..	119 ,, ...	4 ,,
August..	220 ,, ...	7 ,,		——	—
Sept. .	183 ,, ...	8 ,,	Total	1,080 points ...	34 wet days.

All varieties were infected with rust. The plots were cut with the reaper and binder on 24th November, 1921, and threshed on 16th December, 1921.

Variety in order of merit.	Yield per acre based on percentage yield.	Variety in order of merit.	Yield per acre based on percentage yield.
	bus. lb.		bus. lb.
Fulghum	58 24	Sunrise	29 31
Quandong (Cowra No. 22)..	55 29	Lachlan (average of checks)	28 24
Guyra	43 29	Algerian	28 5
Wilga (Bathurst No. 11) ...	31 12	Mulga (Cowra No. 25) ..	19 11
Yarran (Bathurst No 5) ...	29 36		

Late Planting.

The land on which the late-planted section was sown (C block) was cropped with barley during 1920, mouldboard ploughed during April, 1921, and skim-ploughed and spring-tooth cultivated on 11th September, 1921. The seed-bed was in excellent order and free from weeds. The seed was sown on 13th July, 1921, at the rate of 40 lb. per acre, with superphosphate at the rate of 60 lb. per acre. The seed germinated well on 25th July, 1921. The plants made very slow growth and at harvest time were only 2 feet 6 inches high.

The rainfall during the growing period was as follows:—

July 13th to 31st	67 points	3 wet days.
August	220 ,,	7 ,,
September	183 ,,	8 ,,
October	126 ,,	4 ,,
November	119 ,,	4 ,,
Total	715 points	26 wet days.

All varieties were infected with rust. The plots were cut with the reaper and binder, on 5th December, and threshed on 16th December.

Variety in order of merit.	Yield per acre based on percentage yield.		Variety in order of merit.	Yield per acre based on percentage yield.	
	bus.	lb.		bus.	lb.
Wilga (Bathurst No. 11)	54	14	Lachlan (average of checks)	32	8
Fulghum	46	16	Quondong (Cowra No. 22)	28	28
Yarran (Bathurst No. 5)	39	38	Mulga (Cowra No. 25)	28	1
Algerian	36	5	Guyra	26	15
Sunrise	32	19			

Notes on the Varieties.

Sunrise and Mulga (lately Cowra No. 25, a selection from Sunrise).—Two useful varieties to sow early for winter fodder. Sown late, or sown early and fed off, will yield an excellent sample of either hay or grain.

Fulghum.—A heavy yielder of grain; has a short weak straw, and is susceptible to rust.

Algerian.—The best dual purpose variety; has fine strong straw.

Lachlan—The best grain variety for midseason sowing; has strong straw but is too coarse for hay.

Wilga (lately Bathurst No. 11).—Promises to be a heavy grain yielder for early and midseason planting. Straw too coarse for hay.

Yarran (lately Bathurst No. 5).—Similar to Lachlan; a better hay oat but more rust-liable.

Quandong. (lately Cowra No. 22).—A promising grain variety for late planting. A better grain oat than Sunrise, but not so suitable for hay; straw too short.

Guyra.—Growth similar to Lachlan but much later. Does not yield as good a sample of hay as Algerian.

Yanco Experiment Farm.

L. J. GREEN, Experimentalist.

THE area on which the oat variety trials for hay were conducted at this farm consists of a paddock which has been used for these experiments for the last four years, and which, for the ten years previous, had been cropped to lucerne. The soil is a heavy clay loam, which sets particularly hard after rain or irrigation.

The land was ploughed on 22nd February, and after being left in the rough state for four weeks was graded and kept cultivated until 14th April, when check banks were erected 21 feet apart. The plots were irrigated on 1st May, cultivated twelve days later, and sown through the wheat drill at the rate of 58 lb. of seed per acre, with superphosphate at the rate of 60 lb. per acre. Each plot measured one-fifth of an acre.

The soil at planting time was in good condition, though a little dry, but 29 points of rain fell on 18th May, and this materially assisted germination; this fall was followed by 157 points, spread over six days, before 31st May. On all plots the germination was excellent. The growing season (13th May to 1st November) was fair, although from 11th June (when 229 points fell) until 30th July, only 30 points were registered. Bountiful rains fell during August, September and October, however, when 5 inches were recorded in all. The total rainfall for the growing period was 10·02 inches. The crops showed very little disease, smut being the only trouble, and this principally manifest in the plot of White Tartarian.

The weather at harvesting time was particularly dry, especially during the period the cut crop was left in the field before being carted in. This latter operation it was not convenient to carry out until the crop had been stooked between thirty and forty days; but as the stooks were made round and large the delay caused no ill effects, the hay cutting up into remarkably good chaff. The yields were as follows:—

Varieties, in order of merit.	Yield per acre, based on percentage yield.				Varieties, in order of merit.	Yield per acre, based on percentage yield.			
	t.	c.	q.	lb.		t.	c.	q.	lb.
Guyra ...	2	17	0	23	Sunrise . .	2	6	1	25
Lachlan .	2	14	0	3	Cowra No. 6 .	1	12	0	23
Algerian	2	10	1	17	White Tartarian	1	6	1	18
Ruakura	2	8	1	26					

Rainfall and Temperature in New South Wales.

AVERAGE ANNUAL AND MONTHLY RAINFALL FIGURES.

THE tables that occupy the following three pages have been supplied by Mr. H. A. Hunt, Commonwealth Meteorologist, and cannot fail to be of interest to producers generally. In practically every class of primary production, the critical issue is not so much the total annual rainfall, but rather the period of the year in which precipitation chiefly takes place—in other words, the distribution. The tables referred to, in addition to the average yearly rainfall, present the average fall for each month in the year. The figures relate to over ninety recording stations, and in every case they have been obtained from records kept for many years—nineteen years, in fact, is the least.

In view of the importance to certain crops of the occurrence of frost, the earliest and latest recorded frosts at each station are given, and also the extremes of temperature, maximum and minimum.

MAIZE AND SORGHUM SMUT.

THE Department of Agriculture is anxious to ascertain the extent of the damage caused by the above disease and the areas affected, and with that end in view would be glad if branches of the Agricultural Bureau and other farmers' associations and private farmers would furnish answers to any or all of the following series of questions:—

1. Does maize smut occur in your district? If so, is it possible to define the area affected?

2. Can you estimate the percentage of plants in any crop affected with smut this year or in previous years?

3. Do you consider the disease serious? Is it spreading?

4. Have you observed any relation between the amount of infection and—(*a*) type of soil, (*b*) moisture supply in the soil at seeding time or during early growth, (*c*) time of sowing, (*d*) kind and amount of fertiliser used, (*e*) rotation of crops practised, (*f*) variety of maize, (*g*) amount of suckering present, (*h*) any other factors?

5. Have you ever observed sound cobs or grain from a maize plant of which the tassel was smutted?

6. Have you ever seen sorghum smut in your district?

Replies, with specimens, should be addressed to the Under Secretary, Department of Agriculture, Sydney.

RAINFALL AND TEMPERATURE TABLE.

Particulars furnished by MR. H. A. HUNT, Commonwealth Meteorologist.

District.	Altitude above sea level (ft.).	Average Annual Rainfall.	Number of years' records.	Average Monthly Rainfall.												Extreme temperatures.		Frosts.	
				Jan.	Feb.	Mar.	April	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Max.	Min.	Earliest recorded.	Latest recorded.
Albury	512	27·95	55	1·43	1·66	2·03	2·05	2·62	3·45	2·86	2·90	2·68	2·63	1·92	1·72	117·3	19·9	24 March	6 November.
Armidale	3212	31·77	56	3·68	3·35	2·81	1·97	1·77	2·70	2·02	1·84	2·16	2·64	3·28	3·55	105·2	11·2	27 January	6 December.
Barmedman	788	18·36	35	1·63	1·28	1·46	1·33	1·39	2·06	1·59	1·49	1·59	1·61	1·31	1·62	114·3	15·5	27 April	26 September.
Bathurst	2206	23·93	63	2·49	2·16	1·90	1·62	1·80	2·00	1·71	1·77	1·78	2·17	2·18	2·26	112·9	13·0	11 March	4 December.
Bega	50	33·47	39	3·63	3·52	3·98	2·23	2·46	3·34	2·88	2·06	2·19	2·49	2·02	3·17	109·0	20·0	18 April	16 October.
Berrigan	388	18·19	47	1·01	1·24	1·45	1·43	1·85	2·14	1·44	1·84	1·69	1·67	1·27	1·16	112·0	24·9	13 ,,	6 October.
Berry	24	57·84	35	6·15	4·87	6·61	5·46	5·27	5·24	5·52	3·40	3·45	3·07	3·36	5·44	109·8	27·2	30 ,,	1 November.
Blayney	2844	29·51	36	2·85	1·67	2·15	1·84	2·06	3·36	2·84	3·05	2·49	2·58	1·96	2·66	...	...	1 February	27 December.
Bodalla	40	36·47	46	4·00	3·90	4·27	2·81	2·71	2·98	2·51	2·09	2·88	2·76	2·61	2·95	104·0	25·5	18 April	18 October.
Bombala	3001	23·22	37	2·54	1·92	2·25	1·42	1·41	2·34	1·76	1·49	1·74	1·94	1·79	2·62	100·5	17·0	6 January	24 December.
Bourke	361	14·01	49	1·48	1·67	1·26	1·19	1·08	1·21	·93	·85	·83	1·02	1·24	1·25	127·0	25·0	8 May	17 September.
Bowral	2171	37·35	37	3·87	2·82	4·22	2·89	2·92	3·62	3·76	2·51	2·16	2·39	2·50	3·69	104·0	18·0	16 March	18 October.
Braidwood	3157	27·32	44	2·81	2·63	2·47	2·18	2·11	2·42	2·01	1·88	1·84	2·28	2·10	2·59	104·0	16·0	2 January	27 December.
Brewarrina	430	15·51	47	1·98	1·64	1·51	1·09	1·08	1·60	1·09	·94	1·16	1·03	1·21	1·18	120·0	28·0	18 February	1 September
Bundarra	2000	30·19	36	3·74	2·47	2·92	1·91	1·74	2·40	1·71	2·01	2·07	2·76	2·83	3·63	106·0	14·0	10 ,,	2 November.
Carcoar	2325	30·03	41	2·61	1·64	2·02	1·86	2·08	3·80	2·89	3·02	2·63	2·78	2·25	2·45	105·0	18·0	2 January	16 ,,
Casino	82	46·52	48	5·19	5·76	5·89	3·97	3·17	2·48	2·57	1·99	2·14	2·82	3·61	3·93	112·0	21·0	24 May	21 September.
Cassilis	1500	23·58	50	2·51	2·36	2·11	1·47	1·75	1·99	1·75	1·77	1·76	1·70	2·00	2·41	109·5	19·0	10 March	30 November.
Collarenebri	477	19·14	37	2·03	2·03	1·96	1·12	1·43	1·62	1·40	1·19	1·08	1·32	1·81	2·15	115·5	19·0	13 May	20 September.
Condobolin	700	17·18	41	1·80	1·30	1·47	1·32	1·41	1·62	1·24	1·54	1·25	1·41	1·19	1·63	122·2	20·0	26 April	12 October.
Coolamon	823	19·95	34	1·46	1·33	1·68	1·44	1·64	2·39	1·89	1·73	1·69	1·96	1·38	1·36	118·5	25·0	25 April	2 October.
Cooma	2617	19·10	56	2·21	2·06	1·97	1·26	1·25	1·42	1·03	·89	1·63	1·72	1·80	1·86	112·0	4·0	5 January	24 December.
Coonamble	590	19·65	42	2·02	2·03	1·88	1·54	1·60	1·62	1·40	1·42	1·37	1·49	1·52	1·76	115·0	23·0	9 April	10 October.
Cootamundra	1082	23·20	33	1·85	1·28	1·84	1·80	1·83	2·79	2·11	2·18	2·02	2·11	1·62	1·77	112·0	19·9	25 February	7 November.
Corowa	503	20·30	32	1·21	1·21	1·57	1·80	1·82	2·67	2·02	2·01	1·93	1·78	1·42	1·36	112·0	21·0	4 April	30 September.
Cowra	978	23·62	37	2·34	1·52	1·91	1·79	1·63	2·49	1·93	2·08	1·99	2·05	1·45	2·44	113·0	21·0	16 April	24 November.
Crookwell	3000	32·09	38	2·72	1·64	2·53	2·03	2·25	4·07	3·29	3·35	2·87	2·71	2·03	2·60	99·0	20·0	16 January	15 December.
Deniliquin	311	16·30	62	1·01	1·09	1·29	1·35	1·68	1·86	1·28	1·44	1·65	1·51	1·15	·89	116·5	18·0	23 March	6 October.
Dubbo	870	22·12	49	2·09	1·69	1·90	1·78	1·88	2·03	1·66	1·79	1·75	1·59	1·82	2·15	115·4	16·9	14 ,,	1 November.
Eden	107	34.18	50	3·39	3·21	3·41	2·82	3·26	3·34	2·43	2·13	2·38	2·71	2·47	2·63	106·0	29·3	Not reported	Not reported.
Forbes	781	19·84	46	1·72	1·54	1·57	1·59	1·66	1·89	1·55	1·76	1·75	1·73	1·32	1·76	111·0	23·0	6 May	10 October.

Rainfall and Temperature Table—*continued.*

District.	Altitude above sea level (ft.).	Average Annual Rainfall.	Number of years' records.	Average Monthly Rainfall.												Extreme temperatures.		Frosts.	
				Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Max.	Min.	Earliest recorded.	Latest recorded.
Gilgandra	942	23·65	33	2·36	1·96	2·03	2·13	1·90	2·16	1·89	1·90	1·51	1·62	1·82	2·37	109·0	25·0	16 April	4 October.
Glen Innes	3518	31·83	40	4·33	2·99	2·95	1·64	1·81	2·42	1·90	1·96	2·04	2·93	3·04	3·77	107·3	14·4	6 Feb.	19 November.
Goulburn	2097	24·84	57	2·65	2·28	2·19	1·70	1·85	2·00	1·68	1·84	2·06	2·18	2·05	2·36	111·0	13·0	19 Mar	7 December.
Grafton (2)	29	33·86	23	4·49	3·37	4·12	2·47	2·23	2·02	2·13	1·50	1·87	2.20	3·19	3·77	114·0	24·9	23 April	17 September.
Grenfell	1238	24·24	36	2·07	1·66	1·91	1·74	1·32	2·73	2·26	2·22	2·07	1·97	1·54	2·25	109·0	25·0	14 ,,	14 October.
Gunnedah	874	24·23	42	2·39	2·41	2·34	1·60	1·72	1·91	1·60	2·01	1·66	1·97	2·00	2·62	114·0	24·0	7 May	12 ,,
Gulgong	1476	25·66	40	2·46	1·99	2·24	1·90	1·91	2·51	1·94	1·84	1·90	1·96	2·16	2·80	109·0	26·9	20 April	14 September.
Hay	310	14·26	41	·85	·95	1·06	1·07	1·48	1·75	1·18	1·40	1·33	1·19	1·02	·98	117·3	22·9	9 May	29 October.
Holbrook	858	27·97	37	1·63	1·53	2·04	1·86	2·39	3·78	2·93	2·73	2·53	2·37	2·01	2·09	103·0	20·0	1 April	29 ,,
Inverell	1980	30·46	47	3·79	2·80	2·92	1·90	2·10	2·34	2·91	1·95	2·07	2·58	2·67	3·33	110·6	13·4	11 March	6 November.
Jerilderie	364	15·18	34	·97	·88	1·05	1·07	1·58	1·88	1·30	1·62	1·33	1·29	1·24	·97	. . .	..	23 May	8 September.
Jerry's Plains	150	25·29	35	2·91	2·38	2·53	1·76	1·72	1·97	2·08	1·36	1·70	1·77	2·33	2·78	118·0	19·0	29 April	9 October.
Junee	985	20·44	30	1·28	1·09	1·69	1·49	1·70	2·45	1·85	1·95	1·90	1·91	1·46	1·67	111·9	21·0	12 ,,	21 ,,
Kempsey	30	44·42	39	4·69	5·04	5·25	3·72	4·01	3·41	2·99	2·70	2·42	2·91	3·19	4·03	113·0	21·0	31 May	14 September.
Kiama	18	47·60	24	4.15	3·73	3·04	4·40	5·08	3·61	5·53	3·38	2·74	2·74	2·91	4·26	....	....	25 June	14 July
Kiandra	4640	61·42	47	4·12	3·04	4·09	4·13	5·53	8·83	6·36	5·95	6·85	6·57	4·69	4·26	91·0	−4·0	6 January	29 December.
Kurrajong Heights	1870	50·04	30	5·75	6·18	6·23	4·30	4·14	3·03	2·97	2·46	2·93	3·31	4·05	4·69	...	....	.....	.....
Lismore	52	51·05	38	5·74	6·62	7·24	4·55	4·69	3·16	3·63	2·50	2·62	2·51	3·57	4·22	116·2	23·0	8 May	27 August.
Maitland, West	40	34·01	54	3·31	3·32	3·81	2·91	2·81	2·52	2·81	2·13	2·60	2·29	2·33	3·12	114·0	23·0	10 ,,	28 September.
Manilla	1267	26·06	38	3·29	2·28	2·43	1·81	1·54	2·10	1·54	1·53	1·75	2·19	2·58	3·02	...	....	24 April	11 October.
Molong	1736	23·16	37	2·61	1·74	2·34	2·17	2·22	2·93	2·26	2·62	2·22	2·23	1·99	2·83	109·0	19·0	1 ,,	6 November.
Moree	680	23·63	42	2·69	2·76	2·61	1·39	1·79	2·00	1·45	1·42	1·48	1·91	1·97	2·25	117·3	18·0	— April	12 October.
Moruya Heads	55	34·93	46	3·60	3·29	4·13	3·12	2·80	3·04	2·45	1·99	2·74	2·65	2·36	2·67	114·8	22·6	29 May	13 September.
Moss Vale	2205	38·37	49	3·71	3·35	3·77	3·12	3·39	3·62	3·85	2·51	2·40	2·95	2·58	3·12	106·0	18·9	19 January	30 November.
Mudgee	1536	25·75	47	2·17	2·18	1·88	1·76	2·01	2·66	1·95	2·05	2·20	2·15	1·98	2·76	114·9	15·0	22 March	5 ,,
Murrumburrah	1268	23·87	37	2·16	1·32	1·98	1·91	1·65	2·74	2·15	2·25	2·06	1·90	1·60	2·15	114·9	16·0	25 February	24 ,,
Murrurundi	1545	31·21	50	2·98	2·79	2·50	2·14	2·11	3·12	2·45	2·61	2·30	2·44	2·57	3·20	105·5	20·0	30 March	5 October.
Murwillumbah	19	67·37	28	10·25	8·72	10·05	5·50	5·77	4·18	3·71	2·61	3·12	3·57	4·41	5·48		..	8 May	13 August.
Muswellbrook	477	23·76	51	2·38	2·30	2·16	1·64	1·77	2·09	1·92	1·62	1·64	1·74	2·03	2·47	117·6	19·0	21 April	21 October.
Narandera	576	17·12	41	1·37	1·13	1·41	1·20	1·52	2·05	1·38	1·59	1·49	1·62	1·23	1·04	114·5	21·0	20 ,,	16 ,,
Narrabri	697	28·03	51	2·83	2·70	2·63	1·65	2·02	2·40	1·84	1·71	1·61	1·90	2·19	2·60	119·9	18·4	19 March	17 ,,
Narromine	783	18·73	29	1·90	1·33	1·67	1·54	1·46	2·02	1·52	1·74	1·26	1·20	1·40	1·60	.	.	21 April	26 September.

RAINFALL AND TEMPERATURE TABLE—*continued.*

District.	Altitude above sea level (ft.).	Average Annual Rainfall.	Number of years' records.	Average Monthly Rainfall.												Extreme temperatures.		Frosts.	
				Jan.	Feb.	Mar.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Max.	Min.	Earliest recorded.	Latest recorded.
Nyngan	581	16·79	39	1·98	1·87	1·50	1·33	1·38	1·32	1·15	1·34	·99	1·00	1·18	1·72	..	..	— April	21 September.
Orange	2843	35·26	50	2·70	2·45	2·62	2·13	2·92	4·39	3·22	3·51	2·97	3·00	2·00	2·75	101·0	20·5	10 January	16 December.
Parkes	1035	20·92	32	2·16	1·29	1·84	1·52	1·65	2·19	1·80	1·92	1·70	1·59	1·31	1·95	109·0	27·0	28 April	2 October.
Parramatta	49	36·03	55	3·52	3·68	4·17	3·12	2·93	2·94	3·49	2·22	2·15	2·38	2·42	2·96	109·0	26·8	3 May	30 September.
Penrith	89	29·88	25	2·80	2·42	2·89	2·57	2·52	1·90	3·33	1·89	1·59	2·10	2·39	3·48	...	...	....	....
Picton	552	30·65	42	3·33	2·49	3·56	2·90	2·30	2·32	2·56	1·74	1·82	2·32	2·14	3·12	114·0	19·7	15 April	18 October.
Pilliga	773	20·35	30	2·38	2·00	1·61	1·41	1·53	1·93	1·60	1·45	1·16	1·43	1·50	2·05	116·9	23·9	11 May	24 September.
Port Macquarie	44	59·93	60	5·72	6·94	6·34	6·03	6·09	4·46	4·33	3·56	3·95	3·40	3·77	5·34	105·5	24·8	6 June	5 August.
Queanbeyan	1899	22·49	51	2·27	1·72	2·11	1·57	1·63	1·96	1·40	1·59	1·92	2·14	2·09	2·03	109·4	15·8	18 January	25 December.
Quirindi	1278	27·83	38	2·97	2·45	2·54	1·76	1·90	2·52	1·86	2·01	1·80	2·13	2·44	3·45	107·6	13·0	10 February	6 November.
Richmond H. A. College	73	30·25	41	3·36	2·77	3·51	2·38	2·57	2·28	2·37	1·61	1·83	2·04	2·38	3·15	113·0	21·0	15 April	1 ,,
Scone	630	24·11	45	2·66	2·55	2·20	1·62	1·59	1·80	1·73	1·78	1·71	1·70	2·00	2·77	114·4	19·0	22 ,,	5 ,,
Singleton	135	28·67	39	2·79	2·84	3·22	2·25	1·95	2·27	2·42	1·63	1·90	2·05	2·45	2·90	113·9	22·0	5 May	15 September.
Tamworth	1240	27·39	41	2·86	2·49	2·19	1·84	1·79	2·37	1·79	1·94	2·18	2·29	2·70	2·95	110·0	20·0	24 April	18 October.
Taree	30	45·23	38	4·51	5·66	4·98	4·28	3·93	3·19	3·35	2·61	2·59	2·66	3·02	4·59	111·0	25·0	24 ,,	26 September.
Temora	958	20·34	42	1·69	1·11	1·55	1·38	1·64	2·29	1·69	1·78	1·78	1·93	1·70	1·80	...	....	Not reported	Not reported.
Tenterfield	2837	32·30	51	4·27	3·16	3·16	1·73	1·82	2·25	2·30	1·72	2·33	2·62	3·18	3·76	101·0	18·0	29 March	6 November.
Tumut	923	31·23	36	2·17	1·33	2·41	2·17	2·52	4·19	3·19	3·18	2·89	2·79	1·93	2·35	...	..	24 April	— October.
Uralla	3335	29·77	19	3·19	2·53	2·68	1·62	1·77	2·84	2·24	2·14	2·09	2·36	2·86	3·45	102·0	15·0	10 January	5 December.
Urana	400	17·27	48	1·04	1·26	1·43	1·19	1·83	2·19	1·43	1·55	1·53	1·44	1·27	1·11	112·0	28·0	29 April	26 ,,
Wagga	612	21·40	50	1·46	1·36	1·72	1·55	1·86	2·65	1·83	1·97	1·93	2·06	1·57	1·44	119·0	18·4	27 ,,	11 October.
Walcha	3386	31·54	42	3·46	2·86	2·79	1·86	1·84	2·76	1·97	2·06	2·35	2·68	3·29	3·62	104·1	10·0	14 February	3 December.
Walgett	436	18·56	43	2·14	2·05	1·54	1·40	1·66	1·62	1·33	1·26	1·09	1·27	1·50	1·70	122·2	23·2	29 April	9 October.
Warialda	1106	28·09	43	3·47	3·09	2·90	1·64	1·94	2·22	1·76	1·81	1·91	2·17	2·32	2·86	111·0	16·0	22 ,,	2 November.
Warren	645	18·81	32	1·98	1·78	1·65	1·70	1·45	1·71	1·43	1·57	1·03	1·12	1·46	1·93	.	..	Not reported	Not reported.
Wellington	995	23·01	40	2·02	1·54	1·80	1·68	1·94	2·28	1·82	2·04	1·72	1·82	1·94	2·41	112·0	23·3	9 April	1 November.
Wentworth	126	12·18	54	·89	·82	·88	·80	1·31	1·29	·92	1·12	1·21	1·11	·95	·88	119·0	21·0	8 May	9 October.
Werris Creek	1245	26·05	31	2·93	2·19	2·40	1·78	1·46	2·31	2·01	2·02	1·63	1·93	2·35	3·04	107·5	30·0	18 ,,	28 September.
Windsor	58	30·42	52	2·92	3·36	3·58	2·55	2·89	2·76	2·40	1·54	1·84	1·97	2·22	2·39	...	...	....	....
Wollongong	33	44·52	46	4·22	4·47	4·75	4·81	4·38	4·08	3·61	2·38	2·70	2·80	2·67	3·65	113·4	31·9	25 June	19 July.
Wyalong	831	17·55	25	1·74	1·33	1·45	1·11	1·31	2·01	1·57	1·58	1·33	1·42	1·15	1·52	...	....	25 February	24 October.
Yass	1615	23·13	23	1·68	1·02	1·87	1·67	1·61	2·80	2·36	2·20	2·14	2·09	1·76	1·93	108·0	21·0	22 March	24 November.
Young	1416	25·16	50	1·32	1·56	1·88	1·90	2·02	3·02	2·32	2·33	2·24	2·21	1·69	2·07	113·9	20·3	31 ,,	27 December.

The Medics or Burr Trefoils.

E. BREAKWELL, B.A., B.Sc.

To the grazier and pastoralist in this State the most important representative of this valuable family of plants is the well-known *Medicago sativa* or lucerne. Together with *Medicago lupulina* (English trefoil), it is the only member of the family cultivated to any extent. Many others, however, are extremely important owing to their value in pasture land and to their possibilities under cultivation.

Lucerne and English trefoil are perennial plants, and all the others discussed in this article are annuals. The Medics are legumes with leaves like a clover, but characterised by having pods curved or spirally twisted. The following classification should be a useful key to the principal species:—

SECTION 1.—(Plants perennial).

Purple flowers and spirally-twisted pods: *Medicago sativa.*

Yellow flowers and kidney-shaped pods: *M. lupulina.*

SECTION 2.—(Plants annual).

All other Medics.

Sub-section 1.—

Pods provided with spines: thus forming burrs: *M. denticulata, M. minima, M. laciniata, M. maculata, M. truncatula.*

(A.) Plants glabrous or only slightly hairy: *M. denticulata, M. maculata, M. laciniata.*

Leaves irregularly and deeply toothed: *M. laciniata.*

Leaves regularly and only slightly toothed: *M. maculata, M. denticulata.*

Leaves with a horse-shoe shaped brown marking: *M. maculata.*

Young leaves marked with very small scattered spots, disappearing with age: *M. denticulata.*

(B.) Plants very hairy: *M. minima, M. truncatula.*

Leaves comparatively small, and burr-spines long and slender: *M. minima*

Leaves comparatively large, and burr-spines very stiff and short: *M. truncatula.*

Sub-section 2.—

Pods not provided with spines; either smooth or tuberculate: *M. reticulata, M. tuberculata, M. orbicularis, M. scutellata.*

(A.) Pods small, with only two or three windings, reticulately veined: *M. reticulata.*

(B.) Pods large, with several windings: *M. tuberculata, M. orbicularis, M. scutellata.*
  - Pods with equal spirals: *M. tuberculata.*
  - Pods with unequal spirals: *M. orbicularis, M. scutellata.*
    - Pods with four to six flattened turns; seed radicle about half as long as seed: *M. orbicularis.*
    - Pods with five to eight flattened turns; seed radicle as long as seed: *M. scutellata.*

The Burr medics or trefoils are very heavy seeders, and owing to the manner in which the burrs are carried about by sheep, to the wool of which they cling tenaciously, it is easy to understand why they are now distributed through the length and breadth of the State. Again, as the burrs contain up to eight seeds in a pod, it is conceivable how the plants form such a dense mass of vegetation under conditions satisfactory for the germination of the seed. It is very noticeable that the tough pod acts as a protection to the enclosed seed during the germination period. As the pods are lying on the surface of the ground the seed in germinating has to draw its moisture from other sources than the soil. The moisture in this case is in the pods, which, on becoming thoroughly soaked, take some time to dry.

Although sheep have now become accustomed to the Burr trefoils in the wheat-growing districts, exceptional cases of "bloat" have been known to occur. Bloat is most likely when the plants are wet, and when the stock are hungry. Pastoralists who are desirous of introducing the Burr trefoils in their pastures sometimes encounter difficulty in getting the seed to germinate satisfactorily. Such faulty germination is due to the hard nature of many of the seed-coats. Most of these seeds will, however, eventually germinate, though the time taken to do so will vary. It is also necessary that the soil should possess the requisite bacteria for the growth of the plant. When these are absent in the required proportion inoculation of the soil is necessary.

Investigations carried out by American scientists show that the following methods are advisable in obtaining a good stand of trefoil:—(1) Empty a bag of the burrs harvested from good trefoil country into a tub of cool water, and let them stand for two hours, stirring occasionally to loosen as much dirt as possible, in view of re-inoculation at a later stage in the process; (2) remove the burrs from the tub of cool water and immerse for five minutes in a barrel of water almost scalding hot; (3) plunge the burrs for one minute in water kept boiling hot; (4) lift the bag of burrs from the boiling water, plunge first into a barrel of cool water, and then empty into the tub of muddy water in which the seed was first placed.

The muddy water tends to inoculate the burrs, which have presumably had their inoculating bacteria killed by immersion in the boiling water. This inoculation is not necessary where the land to be planted is already known to be inoculated. Sow the seed immediately, or spread out to dry as rapidly as possible in an airy shady place. Such treatment as the foregoing softens the hard seed-coats, and, if necessary, inoculates the seed.

The weight of burr trefoil seed varies considerably when removed from the pods; but the bushel weight of clean dry burrs is fairly constant, ranging from 6 to 12 lb.

The more important medics and burr trefoils are discussed below.

Medicago lupulina.

This is commonly called Yellow trefoil, English trefoil, Hop trefoil, or Black medic. It is sold by seedsmen under the name of English trefoil.

Description.—Stems are four angular and tubescent; leaf stalks, ¾ to 4 inches long; leaflets, oval to broadly obcordate and pubescent on both sides; flowers, yellow in oblong heads; pods, kidney-shaped, ⅛ inch long, blackish when mature, one seeded; seeds, 1/16 inch long, yellow or greenish-yellow in colour.

English trefoil is found growing spontaneously in pastures and fallowed lands throughout the State, but is only abundant on the cold tablelands. In New England it is perhaps more common than elsewhere, and provides a fair amount of winter feed. It is well adapted to heavy rich soils in cold districts. At Glen Innes, in a pasture containing this trefoil, the plants lasted three years and two months, and at the present time (January, 1922), a pasture containing it and Kentucky blue grass is progressing favourably. It provides good bottom herbage where other clovers are not too good. It resists cold better than Red clover, and its succulent growth is more nutritious than medium quality Red clover, although probably not as palatable as most clovers. It is much better adapted to grazing than mowing.

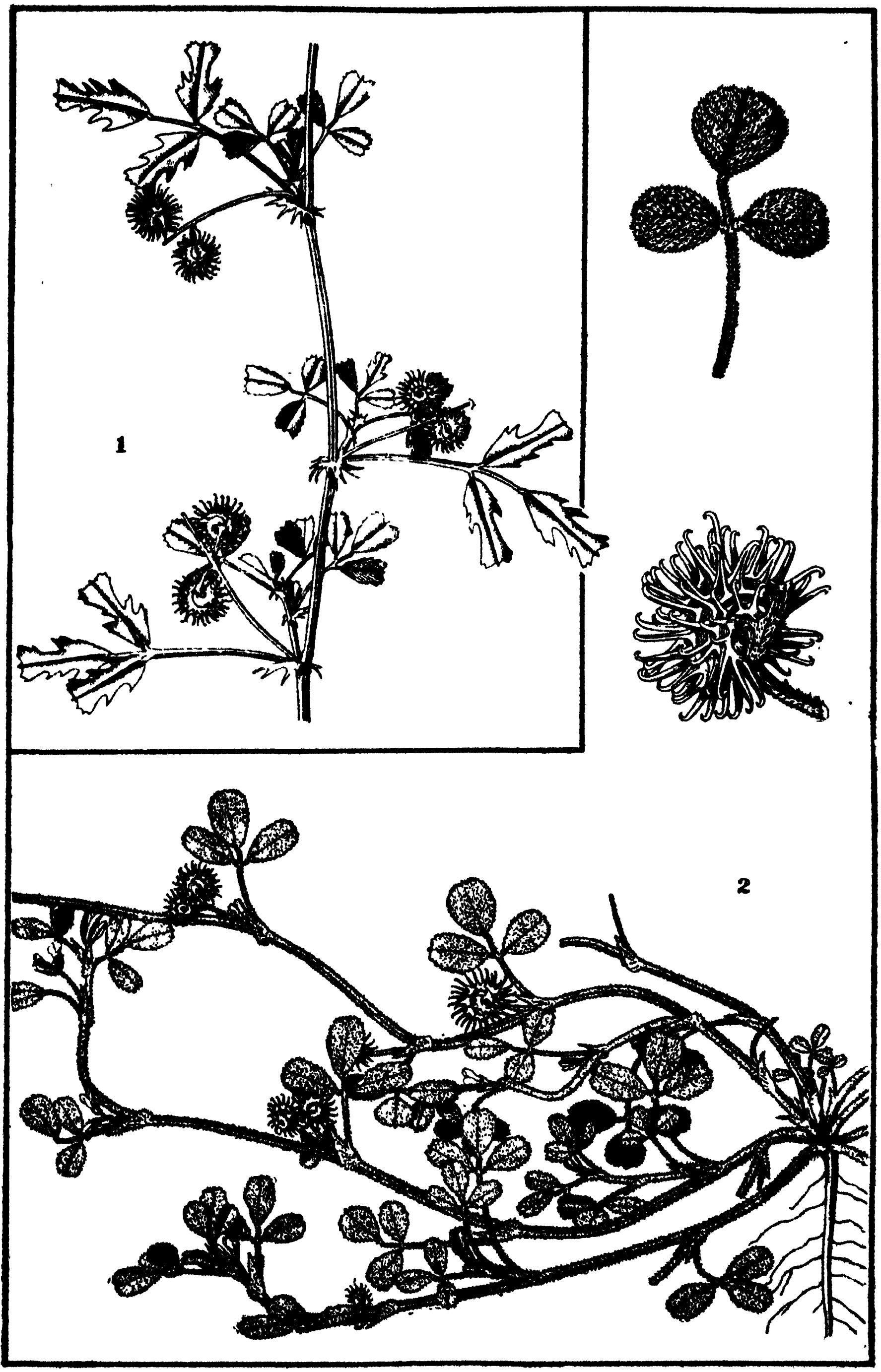
English trefoil can only be recommended for cold localities where other clovers will not thrive.

Medicago denticulata.

This plant is most commonly called trefoil or Burr trefoil, but sometimes Burr medic and Toothed Burr clover. It is a native of Continental Europe and ocurrs spontaneously in pasture and cultivated land throughout the temperate regions of the world.

Description.—Stems decumbent and glabrous; leaflets broadly obovate, glabrous above, sparingly pubescent beneath, often containing very small scattered whitish and dark-red spots disappearing with age; flowers in loose clusters of six to nine on axillary peduncles; pods ¼ to ⅜ inch in diameter, twisted spirally into one and half to four windings, with a double row of stiff erect slightly divergent spines on each winding, the length of the spine being half to full width of the windings; seed from light to brownish-yellow, kidney-shaped, with a radicle half the length of the seed.

Burr trefoil is one of the commonest and most abundant plants growing in New South Wales. It often succeeds in dominating the whole of the vegetation in the wheat-growing districts during the cool months of the year. Its distribution practically coincides with the progress of the plough, and outside the wheat-belt it becomes scarce. Investigations carried out in the distribution of this plant during the past six years indicate that it is



Two Useful Trefoils.

1. *Medicago laciniata.* 2. *Medicago minima.*

dependent on temperatures as well as on soil conditions. It will not grow well where the winters are too long, or where the mean temperatures of September and October are below 52 and 60 degrees Fah. respectively. Its best growth is on the stiff or alluvial soils of the flats. On river flats and on the black-soil plains this trefoil has entirely displaced the original native pastures. Such country is often termed "trefoil country." The growth of such trefoil in the warm months of the year is so abundant that the ordinary number of sheep carried on the farm cannot keep it eaten down. One acre of trefoil at Coonamble carried two sheep from October, 1920, to September, 1921, plus one lamb from April to September, and hardly any impression was made on the growth. A rough estimate of the yield remaining after such stocking was at the rate of 10 tons per acre.

If all this feed were properly utilised there is no doubt that it would more amply serve the grazier's needs than the original native pastures. The trefoil, however, has a short life. Under ordinary conditions it commences growth in the autumn, and seeds about September or October. After this burrs are left in great abundance on the ground, sometimes as many as 1,500 per square yard, and these burrs provide the main source of feed during the summer months on ground often absolutely destitute of vegetation. If the trefoil were conserved as ensilage much more could be obtained from it, and probably less trouble would ensue from "burry" wool. The cost of making pit ensilage has been estimated at 10s. per ton.

Although not as palatable as clovers and some other herbage, trefoil is fairly nutritive, as the following analysis shows:—

	Green Plant.	Calculated on Plant dried at 100 degrees Cent.
	per cent.	per cent.
Moisture	19·85	...
Ash	2·55	2·8
Fibre	4·08	1·6
Albumenoids	5·67	5·09
Ether Extract	1·29	7·07
Carbohydrates	66·56	83·44
	100	100

Nutritive value = 75·13.
Albumenoid ratio = 1 : 12·2.

Medicago minima.

This plant is commonly called Woolly burr trefoil. It is also a native of Europe, but has not spread over the temperate regions of the globe to the same extent as the common burr trefoil.

Description.—A small semi-prostrate plant, intensely hairy, giving it a greyish appearance; leaves only about ½ inch long; flowers in clusters of two to three; pods with four to five thin spirals, partly separated; spines ⅛ inch long and fairly slender; seed like that of *M. denticulata.*

Woolly burr trefoil is not as abundant as the ordinary burr trefoil, but nevertheless, often forms dense mats of herbage on the granitic hills throughout the wheat belt. It is most abundant on the central slopes and tablelands.

Medicago laciniata.

This medic appears better adapted to the north-western and western districts than elsewhere, occurring under conditions similar to those of *M. denticulata.*

Description.—A semi-decumbent plant; young leaves hairy and comparatively narrow and long, margins broken by irregularly-arranged and very conspicuous teeth; flowers arranged in axillary peduncles ¾ to 1 inch long, two to three in a cluster; pod similar to that of *M. denticulata,* with four or five spirals, each spiral containing a row of fairly stiff spines about ¼ inch long; seed similar to that of *M. denticulata.*

This species carries more burrs than *M. denticulata,* is earlier, and is more nutritious. Following is the chemical analysis of a plant from Narrabri district:—

	Green Plant.	Calculated on Plant dried at 100 degrees Cent.
	per cent.	per cent.
Moisture	27·5	..
Ash	2·94	4·05
Ether Extract	1·75	2·41
Fibre ..	5·97	8·23
Albumenoids ...	6·56	9·04
Carbohydrates	55·28	76·27
	100	100

Nutritive value = 65·78.
Albumenoid ratio = 1 : 8.

Medicago maculata (Spotted Trefoil).

This is an annual trefoil or medic, not nearly as abundant as *M. denticulata,* being confined to the colder districts of the State. It is very abundant on the Southern Tablelands, particularly at Moss Vale and at Goulburn.

Description.—A glabrous semi-decumbent plant; leaves similar to *M. denticulata,* but with a dark horse-shoe shaped marking on the leaf; flowers on axillary peduncles, ½ inch long, numbering five to seven in the cluster; pods with four or five spirals, each spiral containing a row of slender curved spines, which sometimes interlace; seed like *M. denticulata.*

This species is a native of southern Europe and Asia, and is very common in the southern States of America. It is there sometimes called *M. arabica,* and receives the common names of Southern burr, Winter burr, Spotted medic, or Spotted leaf burr. It is credited with producing the same kind of nitrogen bacteria as lucerne and *Melilotus,* and is used for improving cotton and maize fields. When grown as a pasture grass stock do not take too kindly to it at first, but later develop a liking for it. It is also used as a hay crop to a certain extent, but plants should be cut as soon as the blooms are abundant, as the plants fall down if left too long.

The chemical analysis of the hay shows: water, 7·59 per cent.; crude fat, 4·22; crude protein, 19·50; crude fibre, 25·70; ash, 9·89. Some interesting investigations have been conducted in connection with the germination of the seed, and the figures have a bearing on all trefoil seed:—

Germination of Seed.

Age of Seed.	Duration of Test.	Germination of Unclipped Seed	Hard Seed	Good Seed.	Germination of Clipped Seed.
Years.	Days.	Per cent.	Per cent	Per cent.	Per cent.
6	12	20	60	80	77
4	12	30	65	95	90
3	7	26	53	79	77
2	7	19	76	95	94

Medicago truncatula (A Burr Trefoil).

This trefoil is not very common in New South Wales, and is characterised by the exceedingly stiff spines and hairy leaves.

Medicago orbicularis (Button Clover).

This species is most abundant in the north and north-western portions of the State, and does not appear to thrive in the very cold localities.

Description.—Plant procumbent, slightly pubescent; leaves up to ⅜ inch wide and ⅞ inch long, rounded at the apex; flowers in pairs on axillary peduncles; pods straw-coloured and papery in texture, twisted into four to six flattened spirals, the margin recurved and the central winding the largest; seed yellowish-brown and flattened, very long; radicle as long as seed.

Button clover is badly affected by dry conditions; but has made promising growth under irrigation at Yanco Experiment Farm.

Medicago scutellata (Snail Clover).

This species has been found growing spontaneously in pastures at Molong, and has done well under irrigation at Yanco. During winter and spring the plants make good growth, throwing out stems about 18 inches long. The stems are very branched and carry a large amount of foliage. The plants remain green for some time after the pods have fallen, and the clover itself lasts longer than the other annual medics.

Description.—A procumbent plant, very hairy; leaves slightly longer than on Button clover; flowers about ¼ inch long in twos; pods ½ to ⅝ inch in diameter, straw-coloured, with five to eight thin spiral cup-shaped windings; seed kidney-shaped and yellowish; radicle half the length of the seed.

Medicago reticulata.

A semi-decumbent plant of vigorous stooling habit, 1 to 2 feet high; leaves pedunculate, ½ to ¾ inch long; wedge-shaped at apex, narrow a base; flowers in clusters of two to three on axillary peduncles; seed pods with two and a half spirals, reticulate-veined, with equidistant and small tubercles on the crest of the spirals; seeds yellowish, radicle half the length of the seed.

Medicago tuberculata.

This species is distinguished from *Medicago reticulata* in having much larger pods, with four or five spirals, and with much larger tubercles on the crest of the spirals. The seed is more curved but flat at the radicle end.

These medics have been tried at Wagga and Yanco, and have done particularly well. They have not, however, spread spontaneously outside the plots, and Subterranean clover, in a winter pasture, has proved too strong for them.

The advantage which these spineless trefoils possess over the burr trefoils is obvious, and they deserve every possible encouragement.

The Crowfoots (*Erodium* sp.)

There are three species of crowfoot commonly found in this State, namely, *Erodium cygnorum*, *E. moschatum*, and *E. cicutarium*. The distinction between these species is as follows:—

Plants 2 to 6 feet high and erect: *E. cygnorum.*

Plants 6 inches to 2 feet high: prostrate or semi-prostrate: *E. moschatum*, *E. cicutarium.*

Leaflets ½ inch wide, slightly divided: *E. moschatum.*

Leaflets ¼ inch wide, deeply divided, and divided segments further cleft: *E. cicutarium.*

The crowfoots are very abundant on the lighter soils throughout the wheat-growing districts. Such country is called "crowfoot country" as distinguished from "trefoil country" on the flats or heavy soils.

Native crowfoot is confined mostly to the warmer parts of the State, such as the north-west and far west. West of Parkes right through to Condobolin it can be found in great abundance. On the black soils of the north-west it will grow to a height of 5 feet in a good season. It is a very rapid grower, its period extending from late autumn to early spring. The mature growth is seriously affected by heavy rains; owing to the succulent nature of its growth it falls prostrate, its leaves fall off, and only a mass of dry stalks remains. All classes of stock do exceedingly well on the green growth, but such is its luxuriant growth in a good season that thousands of tons go to waste. It does not make good ensilage unless mixed with coarser plants, such as grasses or cereals.

Chemical analysis of plants grown on the black soil when they were in flower showed the following:—

		per cent.
Moisture		17·92
Ash		4·00
Ether extract		1·01
Fibre		2·30
Albuminoids		7·00
Carbohydrates		67·77
Nutritive value	77·04	
Nutritive ratio	1 : 10	

Musky Crowfoot (*Erodium moschatum*) is very abundant in the cooler parts of the State. It is generally associated with *E. cicutarium*, but owing to its more vigorous habit of growth, is generally more abundant than that plant. In the very cold districts, where the mean winter temperatures range between 55 degrees Fah. and 62 degrees Fah., it partakes of a rosette habit.

Erodium cicutarium receives many common names in America, such as Pin Clover, Heron's Bill, Crane's Bill, Pin grass, Filaree, Crowfoot, and Alfilarilla. It is sold by American seed merchants under the last name. This crowfoot is thought very highly of in this State. Although it does not produce the body of feed that Native crowfoot does, its growing period is longer, and it is capable of being closely grazed. When it takes possession the plants are invariably prostrate. This crowfoot is also credited with being a first class bee plant.

MILK PRODUCTION THE TEST OF DAIRY COW VALUE

MANY examples might be quoted to show the need for fixing a standard, and for disposing of all cows whose milk yields fall below it. On a farm in the South of Ireland where milk records are kept the yields from the five best and the five worst cows in the herd in one lactation period were as follows:—

Average yield of 5 best cows, 702 gallons milk ; butter-fat, 3·65 per cent.
Average yield of 5 worst cows, 533 gallons milk ; butter-fat, 3·25 per cent.

In calculating the above averages all cows were omitted whose lactation periods were abnormally long, and also the young cows which had produced only one or two calves.

Reference to these figures shows that the milk from the heaviest yielding cows was richer in butter-fat than the milk from the cows which gave low yields. This is not an uncommon experience, but it is contrary to the belief of many farmers. There is no definite relation between the yield of milk and the quantity of butter-fat it contains. The heaviest milking cow in a herd is just as likely to yield rich milk as the one that gives the smallest yield.

It is false economy to retain a low-yielding cow because she breeds good stores; the value of 300 gallons of milk, which may represent the difference between a good milker and a bad one, is, as a rule, greater than the difference in value between a good and a bad store beast.—Extract from "The Management of Dairy Cows," Leaflet No. 62, Department of Agriculture and Technical Instruction for Ireland.

THE remedy for present ills and the strength of the future lies in co-operation and the practical business-like organisation that only co-operation can command. It is by this means that a sound system of marketing (so sadly lacking at present) can be adopted, so that unnecessary middlemen with the profits they absorb may be eliminated, and farmers may ensure equity in the prices received for the class of produce they offer, while at the same time the consumer receives equally fair treatment.—*Journal* of the South African Department of Agriculture.

Weasels and Stoats.

THE SO-CALLED NATURAL ENEMIES OF RABBITS.

WALTER W. FROGGATT, F.L.S., Government Entomologist.

As some of our graziers are advocating the introduction of weasels and stoats into New South Wales as natural enemies of the rabbit, claiming that they will exterminate that pest, it might be well to give our readers some information about these animals.

These two small animals, belonging to the ferret tribe, have a wide distribution over Europe, Asia, and North America, the stoat (also known as the ermine) extending its range into the Arctic regions.

Though they both kill young rabbits and hares, they are omnivorous feeders, and eat up everything else that crawls, creeps, or flies, from small animals, lizards, and frogs, to birds and their eggs. They are most bloodthirsty little creatures, which kill for the love of killing, sucking their victim's blood and leaving the body.

They are known as "ground vermin" to the farmers and gamekeepers in England, and trapping and shooting is carried on against them to check their depredations. Both animals have a somewhat similar range, are somewhat alike in form, and have identical habits, but they differ in certain peculiarities.

The Weasel (*Mustela vulgaris*).

The smaller weasel is not a true forest animal, but takes up its residence near the habitations of men. It is very destructive to chickens, birds, young rabbits and hares. One of the older naturalists says: "The weasel is the smallest vermin of the ferret kind, and is a very noxious animal, but on account of its size, not capable of doing so much mischief. They are particularly destructive in poultry yards on account of their fondness for eggs. They make a small hole at one end at which they lick the yolk out, and leave the shell behind in the fowl's nest." It is a very active animal, climbs trees, and runs up the sides of walls with great ease. No place is secure from its ravages—it frequents outhouses, barns, and granaries, where it catches mice.

Goodman says: "Notwithstanding it might be so far tamed as to take up its residence about our dwellings, it would be exceedingly dangerous to expose the lives of the inmates to the blood-thirstiness of this quadruped, which is rendered doubly dangerous from the circumstance of seeking its prey during the hours devoted by man to sleep."

It can gain access to places which few other creatures can enter, and its swiftness of motion and sharp teeth make the escape of the victim hopeless.

The only value of this animal about homesteads is its destruction of mice; but this is outbalanced by its depredations in the poultry yard; a hungry weasel will slaughter a dozen or more fowls in a night, simply cutting their throats and sucking their blood or biting off their heads.

From the above account it will be seen that the weasel might be called a semi-domestic animal.

The Stoat or Ermine (*Mustela erminea*).

This closely allied animal is larger than the common weasel, measuring 10 inches in length with a tail 5½ inches long, changing its brownish summer coat to white in the winter time. Its habits are identical with those of the weasel, but it is a forest animal and often hunts in small packs, and if possible is more savage and bloodthirsty, even attacking quite large animals and resting birds. The stoat is particularly fond of eggs, and it is stated on good authority that on the coast of Norway, when the sea is calm, it will swim across to the small islands to feast upon the sea-birds eggs.

Another English writer describing the stoat says: "This animal in some places is called *a cain*, and is the worst small vermin that exists, for if they approach any warren, pheasantry, or chicken garden they do incredible mischief, for whatever they kill they seldom eat, but only suck their blood, on which account they are more destructive and pernicious by far than all the vermin of the ferret kind put together."

A Warning.

Now, these are the two small carnivorous animals that the sheepowners and farmers are advised to introduce and spread broadcast over the land as *natural enemies of the rabbit*. What would become of our native fauna if the stoats and weasels increased in sufficient numbers to be active agents in rabbit destruction! What would happen to our birds? None of them, even in the trees and foliage, would escape from these active night-climbing blood-suckers. Everything would vanish—frogs, lizards, snakes, the whole fauna of Australia. There would, under Australian conditions, be nothing to check the increase and spread of these animals while their food supplies lasted.

But long before the exhaustion of their natural food supplies, the stoats and weasels would have found how helpless a freshly dropped lamb was, and even if the sick ewes were not molested, the lambing would show a very small percentage, if any escaped.

The bush mother would find the animals invading the house for food, and a hungry weasel or a stoat would have no compunction about attacking an unprotected baby sleeping in its cradle. It would become an ever present terror to the anxious mother on the land.

The fox is bad enough, but the bush poultry yard would have a worse enemy in these small, active, climbing creatures, which would be able to worm their way through the smallest hole in the wire netting.

Many bird lovers have claimed that the poison cart is killing out our native useful birds, but the poison cart would prove a very small factor in that particular matter compared with the stoat and weasel.

Better Bananas.

HOW TO DE-SUCKER TO GET THEM.

REG. G. BARTLETT, **Assistant Fruit Expert.**

IN view of the new standard of compulsory grading about to be introduced into Queensland in connection with the marketing of bananas, the pruning (or de-suckering) and manuring of banana plantations must become the most important factors in successful banana culture.

The Reasons for Pruning or De-suckering.

Pruning—or de-suckering, as it might be more properly called—is neglected by some growers, and imperfectly understood and practised by others. Some are content to give little attention to it, while others either do it to excess or at the wrong time. Chinese growers in New South Wales in some instances carry de-suckering to extremes by allowing only two main plants with two followers. The result is an excessive growth of sucker and leaves, without a corresponding increase in the size of the bunch and the fruit thereon.

Pruning is carried out for the reason that (1) it conserves plant food, and (2) it results in larger bunches and better fruit.

The removal of such suckers as are not required to produce the crop of fruit is necessary, and should be done when the suckers are not more than one foot high. The larger the sucker grows the more food it takes from the parent bulb, and the more its young roots interfere with the roots of the parent sucker, a reduction in the size of the bunch being the ultimate result.

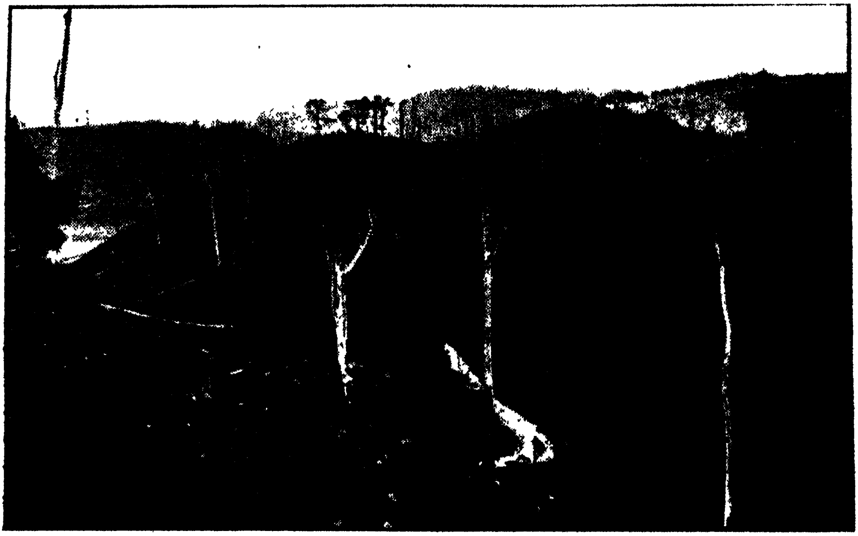
It has been proved often enough that the more suckers there are to a stool, the smaller will be the bunches, and the longer will it take for the fruit to mature. The reason is palpable—the suckers are competing with the mother plants for the plant food that is in the soil—indeed, they are actually fed in part by the mother plants.

If de-suckering is to be carried out to the best advantage, it must not be done earlier than January or February. It is a grievous and expensive mistake to do it in the spring. No doubt it looks reasonable, at a time when the suckers are drawing heavily on the plant, to reduce their number, but as a matter of fact the plant is then in such a vigorous condition that the effect of de-suckering is to force out an extra growth of suckers, with the result that more labour than ever becomes necessary later in the summer to cut out these forced suckers. Had the pruning or de-suckering been delayed until after February, no further suckers would have developed, and one operation would have sufficed.

How to carry out De-suckering.

Great care must be taken when removing suckers so that neither the mother plant nor its roots are injured. The hoe and the mattock are not recommended for the operation, owing to the damage they cause to the main root system.

A new tool has recently been designed by the writer and approved of by the Department for this work. It has been found that it is not only most efficacious, but it enables the work to be done in about a quarter of the time of any implement previously employed and it involves no injury whatever to the plant. It may be described as a gouge-auger, made out of spring steel and sharpened on all edges, and it has been called the "Bartlett Banana Gouge." It was designed on the principle of the old butter taster. known to those who remember the time when butter was sold in kegs. It has been in use for some little time, and growers using it have expressed the opinion that it fills a long-felt want. Patterns have been supplied to various blacksmiths in the banana-growing districts, and the accompanying rough sketch is supplied for the benefit of those who may be able to make it themselves on the farm.

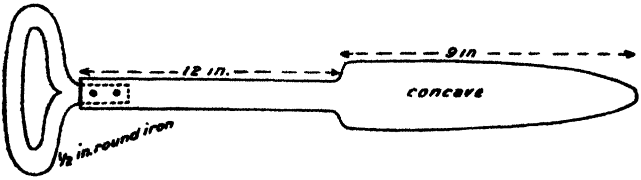


A Banana Plantation on the Richmond.

The tool is inserted into the base of the sucker to be removed, at an angle of, say, 30 degrees from the vertical, and then by a swing of the handle to right and left the sucker is removed, with a section of the bulb in the shape of an inverted cone. The operator can then push the tool in vertically into the stump left, and by using it auger-fashion, remove a further conical section right through to the soil underneath. As the tool only touches the sucker in all operations, it is not likely to be dulled by contact with stones, &c., as is so often the case with other tools.

It is generally found most profitable to have only three main suckers forming a stool, with three "followers" (small suckers) to take their places. As each parent sucker in an established field will produce from three to five suckers, choice must be made as to which shall be left as the "follower," and it is there that individual judgment is necessary. As a general rule the following kinds of suckers should always be taken out, because none of them will produce a large bunch:—(1) Those situated inside the triangle formed by the original suckers of the stool; (2) those with broad, flat leaves, often called umbrella or water suckers; (3) those small ones, 4 to 12 inches long, to be found on stumps.

In selecting the suckers to be retained, preference should be given the following:—(1) The sucker with the largest bulb; (2) the sucker farthest from the parent (this ensures room for development); (3) the most pointed sucker with narrow leaves—always a vigorous type of sucker.



A "Banana Gouge" or De-suckering Implement.

Specially devised for the purpose by Mr. R. G. Bartlett.

The stool should be encouraged rather to spread along the row than between the rows, so that space may be maintained for inter-cultivation with horse implements. On the hillside plantations so common in New South Wales, it is wise to retain the majority of the followers on the upper side of the stool; one follower on the lower side and the others on the upper side of the stool will generally be found to give the best results. The pruner will find, however, that every stool must be judged on its own merits, no hard and fast rules being possible.

ELEPHANT GRASS (*Pennisetum purpureum*) AT COONAMBLE EXPERIMENT FARM.

DURING the summer months the plot of elephant grass at this farm was watered periodically and fed off with horses and mules with success. Sheep were not turned on to it, but the horses and mules ate it readily, even though there was other feed available at the time.

With the bore water available here, it would appear that the grass is going to be very valuable in dry times, for it readily responds to the application of water and will withstand dry periods without drying out.—R. W. McDIARMID, Manager.

THE CONTROL OF WHITE LOUSE OF CITRUS.

A REPORT by Mr. O. Brooks, Fruit Inspector in the Gosford district, concerning the results of experiments carried out by him with atomic sulphur and colloidal sulphur as controls of white louse of citrus trees, states that "the spray has not been satisfactory. I have examined the scale on several occasions lately and have found quite 50 per cent. of live scale. I would suggest that the experiments with the above mixtures be discontinued, as apparently they will not control white louse." The experiments are accordingly being terminated.

Black Spot of the Vine

(*Glœosporium ampelophagum*).

EXPERIMENTS WITH CONTROLS, 1920–21.

W. LE GAY BRERETON, Assistant Fruit Expert, and C. O. HAMBLIN, B.Sc., B.Sc. Agr., Assistant Biologist.

A SERIES of experiments for 1920-21 was planned and carried out at Hawkesbury Agricultural College, the objects being:—

1. To determine the best winter swabs and sprays.
2. To test summer control sprays.
3. To test late season sprays for ripening fruit.

Very little "black spot" appeared in the vineyard during the year, so that no reliable deductions could be drawn as to the control of the disease. Mr. Eastwood, Orchardist at the College, prepared and applied all the swabs and sprays.

Swabs.—Some information was gleaned as to the effect of the sulphuric swabs. The Orchardist stated that the application of the swab (5 lb. sulphate of iron, 1 gallon of water, ½ pint sulphuric acid) delayed the bursting of the young buds about ten days. Its effect on the control of the disease could not be determined as no "black spot" appeared in the check plants.

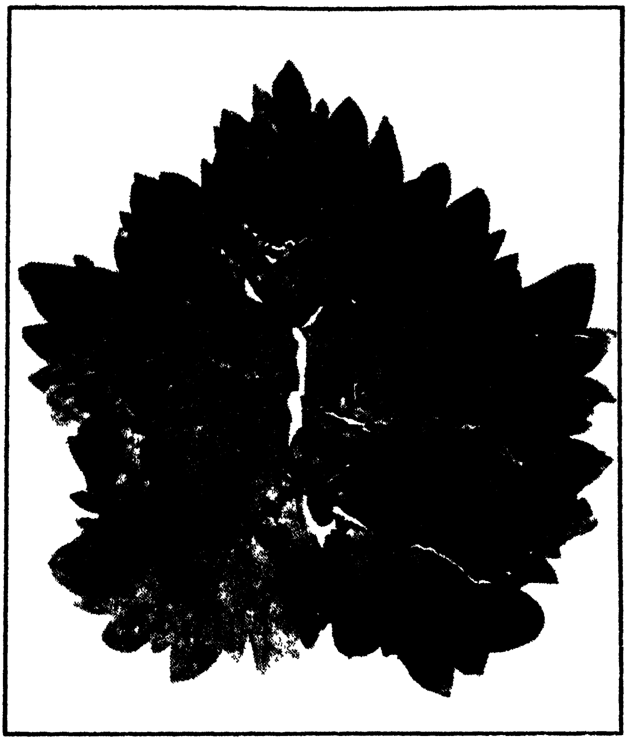
The Bordeaux sprays used in this experiment once again demonstrated their value in controlling "downy mildew," which was very prevalent from the 17th January onwards. Blocks of this experiment which received only winter treatment all developed signs of "downy mildew." Those sprayed with 6–4–40 Bordeaux and 6–4–50 Bordeaux showed very little signs of "downy mildew."

Work was also carried out at Yanco Experiment Farm during the year under the supervision of the Orchardist, Mr. J. M. Arthur, who reported as follows:—

"*Swabs Applied.*—No. 1—Sulphate of iron, 50 lb.; sulphuric acid, 1 gallon; water, 10 gallons. No. 2—Sulphuric acid, 1 gallon; water, 10 gallons. No. 3—Saturated solution of sulphate of iron; sulphuric acid, ½ gallon; water, 10 gallons. No. 4—Sulphate of iron, 35 lb.; sulphuric acid, ½ gallon; water 10 gallons.

"Formula No. 2 is the cheaper and easier to mix. All formulæ were applied twice, with check rows unswabbed and rows swabbed with each formula once only. The periods for the application of the double swabbing were 30th July and 30th August; the latter when the buds were swelling, and in many instances bursting into foliage. In all cases where the buds had burst the foliage was burnt off with the swabs. The rows that were swabbed were longer in bursting into foliage than those not treated. The single application retarded the bursting of the buds from a week to ten days, and the vines which were treated twice were from ten to twelve days later than the untreated.

"*Winter Spraying.*—No. 5—Bordeaux mixture, 6–4–22. No. 6—Burgundy mixture, 4–6–22. No. 7—Lime-sulphur solution, winter strength.



Black Spot on a Grape Leaf.

"The spraying experiments had no control over the period of the buds bursting. In all instances, both with the swabbing and spraying experiments, the 'black spot' developed simultaneously. This was due to the disease not making its appearance till late in the spring or early in summer.

"It might be added that this has been the experience at Yanco for three consecutive seasons."

It is evident that in a district where "black spot" is likely to develop very early in the spring swabbing may delay the growth of vines from a week to ten days. By killing a great many of the overwintering spores in the cankers on the stems the application of a swab undoubtedly reduces the total amount of infective material, and is thus efficacious if climatic conditions favour the disease.

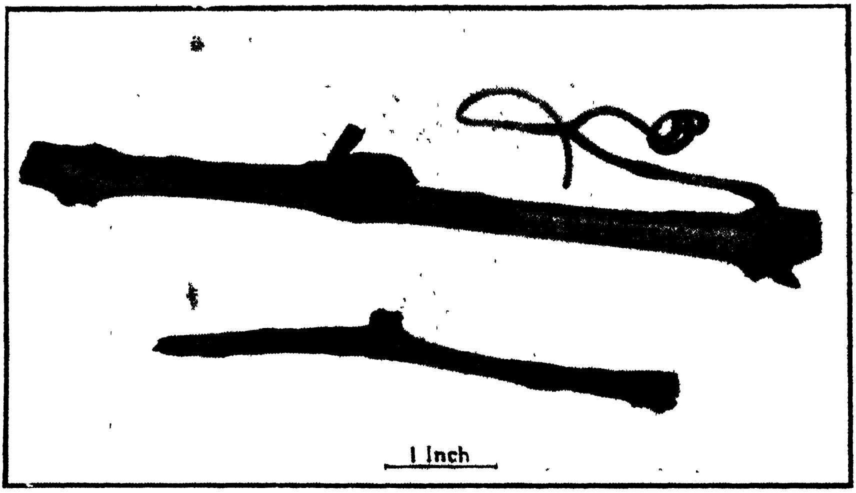
Pending further investigations the Department continues to recommend the following treatment for combating this disease:—

Controls:—

1. After pruning, all cuttings should be collected and burnt.
2. If time and labour permit, the vines may have the loose old bark removed and burnt. To leave it on the ground is worse than useless.
3. While dormant, the vines should be swabbed or sprayed once or twice with one of the following solutions:

   (*a*) 1 gallon of water.
   5 lb. sulphate of iron.
   ½ pint commercial concentrated sulphuric acid.

   Dissolve the sulphate of iron by suspending it over-night in a piece of bagging in the water. In the morning add the acid slowly to prevent any spurting. Use a wooden or earthenware vessel.



Black Spot Cankers on Canes and Tendrils.

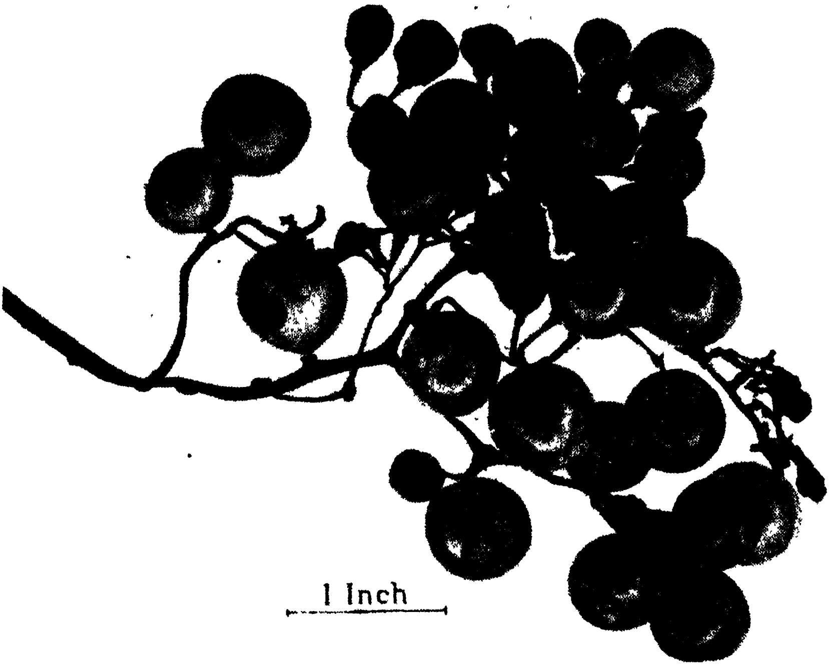
Another method is to pour the sulphuric acid over the sulphate of iron and stir well, then add boiling water, slowly stirring all the time. There is greater danger of spurting in this case.

Caution.—Sulphuric acid must be added to water carefully, or it may splash up and burn the hands and face of the operator. If it is added to the water, it should be poured in slowly in a thin stream, the water being stirred at the same time. Sulphuric acid has a very corrosive action on all metals except lead.

(*b*) 10 gallons of water.
1 gallon sulphuric acid.

This formula is recommended where spraying is carried out in preference to swabbing. It is also an effective swab.

The swabbing solution is best applied by means of a small tar brush or a brush made of binder-twine on a long handle, or with a mop made of woollen rags tied to a stick. The brush or mop must contain no metal. In spraying the solutions, specially constructed lead-lined knapsack spray pumps may be used. Large pressure cask pumps are also obtainable.



Black Spot on Doradillo Grapes.

If the disease has been rampant in the previous season, two applications are desirable. When only *one* swabbing is given, it should take place as near as possible to the bursting of the buds, but it is important not to leave the application so late that injury may be done to the bursting buds, as unexpected sprouting of the buds might then prevent the work being done at all. Where two applications are decided on, the first should be given a month to five weeks before the bursting of the buds, and should be followed by the second application just prior to the bursting of the buds.

Swabbing delays the bursting of the buds a week or ten days, and is advantageous, on that account, in districts that are subject to late frosts

Swabbing undoubtedly reduces the total amount of infective material upon the vines, and thus provides against an early attack of the disease.

4. In the spring, when the buds are bursting, spray with Bordeaux (6-4-40). When the later buds are bursting, spray with Bordeaux again at summer strength (6-4-50) If weather conditions favour the disease, spray just before blossoming, and again as soon as the fruit has set. Later applications must be governed by weather conditions. The weather conditions favourable to black spot are—
   (*a*) Humid atmosphere;
   (*b*) Rain or dew, followed by sunshine.

If, through any cause, the spraying just before blossoming is delayed, and the weather conditions are favourable to the disease, it would be better to continue the spraying rather than risk the destruction of the crop through the disease, but, as a rule, spraying should be avoided during the blossoming period.

The spraying measures recommended for the summer control of black spot are equally valuable in controlling downy mildew, which, however, generally appears later in the season.

FUEL VALUE OF WOOD.

THE fuel value of wood is about in proportion to the weight of the wood when it is thoroughly dry. The heavier the dry wood the greater is its fuel value. Dry wood gives out more heat than wet wood, because with wet wood much of the heat is used to evaporate the moisture in the wood so it will burn. Cordwood from living trees contains from 25 to 45 per cent. of water, and when such wood is burned it takes about half the wood to dry out the other half so it will burn It is therefore more economical to use dry wood. A standard cord, which is a stack of wood 8 feet long, 4 feet wide, and 4 feet high, of heavy dry wood has about the same fuel value as a ton of hard coal. A. K. CHITTENDEN, in the *Quarterly Bulletin* of the Michigan Agricultural College Experiment Station.

A SPRAYING CAUTION.

VARYING results having been reported from the use of washing soda spray for control of white wax scale, and damage to foliage even when the spray was made according to the departmental formula of 1½ lb. soda to 4 gallons water, the matter was referred to the Chemist's Branch for investigation. Mr. A. A. Ramsay, Principal Assistant Chemist, reported that such damage to the foliage is caused through growers using washing soda that has been kept in stock for some time; under those conditions the water dries out. and the substance becomes powdery and much stronger in carbonate of soda. If only fresh, clean crystals of washing soda are used when making the spray. there will be little or no damage to the foliage of the trees sprayed.—W. W. FROGGATT, Government Entomologist.

The Lemon.

W. S. ARNOLD, Manager Soldiers' Settlement, Kurrajong.*

THERE being about 3,000 lemon trees on the soldiers' settlement in this district, one naturally wonders whether they can be made to pay, and what are the methods that can best be adopted to that end. Personally I feel quite sure they will hold their own with other citrus.

The several useful species of citrus, including lemon, are supposed to have originated in China and Central Asia, and to have been taken to Syria by the Arabs. Later the culture was mostly confined to Italy, Spain, and the Azores.

The lemon is utilised in various ways, and is a very serviceable fruit. It is not attacked by birds, flying foxes, and fruit fly to the same extent as other fruits, and the period of harvesting is much longer; and it therefore is often preferred to stone or pome fruit for an orchard in this district.

Requirements of the Lemon.

The following conditions are absolutely essential for the successful culture of the lemon:—

1. A suitable climate, site, and soil.
2. A proper preparation of the soil.
3. The selection of healthy trees, worked on the right stock from tested fruiting trees.
4. A full and regular supply of the right food.
5. The roots must be disturbed as little as possible (this is of paramount importance).
6. Clean culture at all times.
7. Last, but not least, shelter from strong winds and cold air currents.

Non-success is not so much due to the effects of the soil and climate as to carelessness or ignorance in the treatment of the tree.

Generally speaking, the common rough seedling lemon is used for stock. It is hardy, vigorous, acclimatised, and of near affinity, and fibres so well that there is little risk in transplanting. For certain sites and soils the seedling orange, or *Citrus trifoliata*, is used. The scion or bud inserted on the stock must be from tested fruiting trees for the best results. I had in a lemon orchard comprising 1,000 trees six or eight trees that were absolutely useless and barren. What would have been the result if that wood had been supplied to nurserymen?

It may be of interest to state that we have an indigenous citrus plant, known as the Wild Lemon or Desert Conquot, found in various parts of New South Wales and Queensland.

***This paper was read by Mr. Arnold at a meeting of the Tennyson-Kurrajong branch of the Agricultural Bureau on 1st May. It is particularly applicable, of course, to that district, but some of its suggestions may be of use to growers in other parts of the State.**

It attains a height of 15 feet, and grows in the very dry areas around Broken Hill. It is found in saline and alkaline soils, and stands more cold and drought than any of the evergreen citrus stock, the latter being very sensitive to salty soil and too much water, drought, or cold. It is found that all commercial varieties work readily on this stock, and it is hoped that it will prove resistant to the many insect pests and fungous and bacterial diseases that attack our citrus, and also that its vigour, longevity, &c., will go with it. When in the Botanic Gardens in Sydney recently I saw some of these plants, and have asked for some for experimental purposes at the settlement.

Ordinary good soil of fair depth and altitude, which is not too wet or too exposed, will suit lemons, but for preference an intending grower should take a north-east aspect.

A common fault, I think, is planting immediately after clearing, without giving the land a chance to sweeten. Ringed country is sweeter than green timbered land. My desire at the settlement was to establish our own nursery, to work from selected and tested trees, and to plant when the ground was in a thoroughly sweetened and friable condition.

Low-lying land, where temperatures are low in winter and early spring, is no good for lemons; neither are soils where, even if out of the cold, the clay bottom is undrained.

A question that has several times been asked me is why citrus do well near the river's edge at North Richmond bridge, and not suffer severely from cold in the winter, while trees planted at a higher altitude a quarter of a mile away will possibly get frost-bitten. The only answer I can give is that the heat absorbed by a large expanse of water during the day takes longer to be given off at night, and hence land adjacent to the river is enveloped in warmer air than land further away. In small creeks this does not apply, but the reverse.

Preparation of the Soil and Planting.

One of the best orchards in Kurrajong was broken up 14 inches to 16 inches deep with a bullock team. If, instead of doubling one's orchard area, the existing area was subsoiled and underdrained, far better results would be obtained than from an extended area. If a grower wants another 10 acres he should not mortgage what he has, but should put it underneath. It is often said lemons are surface feeders, and so they are if the roots can go no further. I have seen the roots of lemons uncovered 10 feet to 15 feet from the surface by a landslip.

Having the land well pulverised, subsoiled, and drained (naturally or artificially), the planter should peg out the area not less than 20 feet square, or (as we cannot irrigate) 22 or 24 feet would suit the droughty conditions which come sooner or later.

In fairly level land, roll the block and get a good ploughman to strike out the furrows at the distances required each way, and then plant where the furrows cross.

Have nothing but strong, well-grown, fibrous-rooted maiden trees. If the soil is not too wet and the weather mild, excellent results are obtained from March and April planting in high ground. In lower areas I prefer to plant in spring.

The planting operation is most important. The greatest care should be taken not to expose roots to sun, wind, or air; they should be covered with damp bags, and only taken out just prior to being placed in position. The roots should be spread naturally as they came from the nursery, and not planted more than 1 inch deeper, so that the union is just out of the ground.

Manuring.

Without doubt in my mind the best method of supplying lemon trees with the most suitable plant food is to soil the trees. In parts of Kurrajong this is quite a regular thing. Adjoining the settlement is an example of top soil being carted from the road and tipped at the rate of one load to each tree.

Where bush lands are conveniently close soiling should be a regular part of the year's programme. It is expensive, but the results warrant it, and I could mention the names of most successful citrus-growers who still continue the practice, one even using a Fordson tractor and scoops for the purpose.

The fertility of the soil must be maintained, otherwise the orchard will not last, and the quantity and quality of the fruit will fail.

Naturally a half-fed tree becomes weak, and cannot resist the attacks of insect and fungous pests, and its remunerative period, instead of being about twenty years, is often less than ten. The reason why I prefer soiling is because artificial manures so often are of a forcing nature and violent in their action, and must be therefore used with far greater care and judgment than soiling. For example, a heavy application of blood and bonedust in the spring of the year, prior to a rainfall, would cause strong, vigorous, and sappy wood growths at the expense of fruit. It would also increase the thickness of the skin and the amount of rag. If it is impossible to soil the trees I would recommend moderate applications of fertilisers just before the two main growths, about August and January. The practice of intercropping through the orchard should be discouraged; the trees should get the full benefit of the fertility of the land, so that the grower in turn may get the utmost from his trees.

An average rainfall of about 35 inches, such as we get on the Kurrajong, provided proper cultural operations are maintained, will suit the lemon.

Cultivation.

If in the course of the preparation the land was ploughed and subsoiled, deep cultivation need not be practised—anyhow not near the trees. To suit horse cultivation, the trees should be prong-hoed in squares extending 1 foot beyond the outside leaves. Most of the feeding fibres extend this far, and the plough, if let in too deeply and used any closer, would mutilate and destroy these most valuable and essential feeders.

During early spring, and throughout the summer, and up till about March, weeds must not be allowed to grow. Shallow cultivation during dry weather will make a dust mulch, thus retarding capillary action and keeping the soil in moist condition. Crops for green manure can be sown in April, but they must be turned under before early spring.

Shelter Belts and Breakwinds.

Too much importance cannot be attached to the value of shelters. Natural timbers should be left where possible on the western side, as the wind from that quarter causes most havoc in this part. Trees left on the south side are also beneficial. Often a good hillside acts as a break. Where nature does not provide these essentials for the well-being of the orchard the man must supply it. I saw one orchard with a 10-foot galvanised iron fence on the western side as a shelter. Pines, sugar-gums, loquats, wattles, &c., can all be pressed into good service, and will pay for any attention given them. Evergreens are better than deciduous trees, as the circulation of cold air in the winter will cause as much damage as the boisterous westerlies.

Pruning and Training Lemon Orchards

The usual practice in Kurrajong is to allow the trees to grow as they like. One can see in this district how trees that are not pruned shape themselves. There is the strong, vigorous, upright growth made in the first three years, and then, as the growth steadies, flowers form on the tips, fruit sets, and the trees become somewhat like a weeping willow, the weight of the excess of fruit and the lack of a strong frame causing limbs to split in a wholesale manner. The life of the tree is greatly reduced as a result, disease often sets in, the orchardist gets discouraged, and time is lost in rebuilding the tree, if, indeed, such an attempt is made at all.

When one realises the heavy crops lemon trees produce, it will be recognised that the most important thing is to establish a framework that will support those loads without breaking. A crown should be formed, so that no limb is directly opposite the other, three or four limbs being enough. Lemon trees are like most other fruit trees. The strong upright growth is mostly wood, and will form the framework. The fruit limbs are slighter, and vary from 1 foot to 2½ feet in length. They are easily distinguished by their position on the frame of the tree and by the end of the limb, which shows matured leaves and indications of buds forming at the tips. Fruit spurs are the growths that come on these fruit limbs, and also on the framework of the tree.

Season by season the strong vertical wood growths are reduced to 9 or 12 inches, leaving the fruit limbs, and thus each year a decking is added to the tree. The fruit spurs develop on the fruit limbs, and by the time the tree has ceased to throw out upright, strong wood, you have a framework holding a tremendous crop of lemons, which do not get scratched and blown about, because the fruit is nearly all on spurs near the trunk. The result is fruit of the best quality.

Fortunately the lemon tree can be easily manipulated, and experiments will be conducted with a view to making trees bear their fruit when the latter is wanted. This will be done by not allowing them to bear at all in the winter. The fruit set after the spring blooming will be clipped off, so as to encourage blossoms to come later on, the object being to get a lemon that will not want a long period for curing, and that will be ready when the demand is keenest, namely, November to March.

The Sweet Rind lemon, or Smooth Rind, as I think it was called originally, is preferred for this summer crop, as it has a natural tendency to fruit in the summer and is thornless. Lisbon is a good hardy old sort, a sure cropper, but thorny, and carries its main crop in the winter. It would be more suitable for drier climates, where the winter fruit could be kept six months if handled carefully.

For twenty years I have been watching a tree I planted for Thornless Lisbon, and its habits are such that I feel sure we can get trees to "fruit to order," so to speak. The coastal district is, unfortunately, not the most suited for curing lemons, and I candidly think that if we persevere with the idea of "clipping off" young winter fruit we will produce crops when most needed, and thus make up for unfavourable climatic curing conditions.

Lemon Curing.

We can grow fruit here to perfection, and in any quantity, yet our cured lemons do not come up to those from Sicily, Italy, and California, either for actual appearance, weight, or keeping qualities. Practice makes perfect, however, and we must try again.

One year I clipped 12 bushels of large green lemons in May, and after allowing them to wilt for nearly a fortnight stowed them away in a bark shed within a larger one. Some of the fruit was papered and some was just packed into paper-lined cases. At the beginning of each month we picked out the bad ones, and at Christmas time we still had about 20 per cent. of excellent quality lemons. This goes to show that in some seasons we can cure lemons, but we have a great deal to learn.

To conclude, this opportunity must not go by without mentioning co-operation. The time has come when it seldom pays to stand alone. We must unite and organise, have our packing and curing sheds, and be linked up with other districts. We should have our representative in the central citrus exchange, get crop estimates of other districts, and so co-operate that each district may have a regular quota to put on the market, thus regulating supplies and prices.

In other countries co-operation has placed the fruitgrower in a far better financial position than he was before, and it behoves us to improve ours and obtain the best possible results at the least expense and worry.

When the trees cease to pay for the labour bestowed on them, don't let us turn them out to grow scale and other insect and fungous pests that will make them a curse to the neighbourhood. Rather let us root them out and burn them.

Orchard Experiments.

SPRAYS FOR PEACH CURL ON TRIAL AT YANCO.

W. J. ALLEN and J. M. ARTHUR.

SPRAYING experiments in connection with the control of peach-leaf curl have been carried out at Yanco Experiment Farm for some years past, and were continued last season. The following presents the results from 1916 to date:—

The 1916 *and* 1917 *Experiments.*—The experiments carried out in 1916 and repeated in 1917 were chiefly designed to determine the best period at which to apply lime-sulphur* for the control of this disease. As in the other trials here reported the Elberta peach, which is particularly susceptible to peach curl, was the variety used. The following paragraphs show the period of application of the spray on each of the four experiment plots and the results obtained:—

Plot 1.—The spray was applied when the trees were perfectly dormant. This gave an excellent result. Out of the twenty-one trees in this plot only an occasional leaf developed the disease.

Plot 2.—The spray was applied when the buds were swelling. The result was inferior to that on Plot 1. A fair proportion of the foliage developed the disease.

Plot 3.—The spray was applied when the blossoms buds were at the pinking stage. The result was inferior to that on Plot 2, a higher proportion of the foliage being diseased.

Plot 4.—Two applications of sprays were made; the first while the trees were dormant and the second when the buds were swelling. The result on this plot was exactly similar to that on Plot 1. A comparison of this result with that of Plots 1 and 2 indicates that the second application is not necessary.

All the unsprayed check trees developed the disease badly. A report on these experiments appeared in the *Agricultural Gazette* of July, 1918.

The 1918 *Experiments.*—As in previous seasons the midwinter or dormant-stage application of lime-sulphur sprays gave better results than the later applications, *i.e.*, when the buds were swollen or when blossom buds were showing pink. The trees sprayed when dormant were almost perfectly free from the disease. The late applications, though partially effective, showed a fair percentage of diseased leaves. Several unsprayed check trees left throughout the block were in every instance badly attacked by leaf curl, fully 95 per cent. of the foliage being diseased.

*** In all cases the lime-sulphur was freshly made and diluted to winter strength by the departmental method. In all of the experiments now under discussion the method of preparing and diluting the lime-sulphur was that recommended in the Department's publications, Spraying (Farmers' Bulletin, No. 72) and Spray Leaflet, No. 3 (Lime-sulphur), unless otherwise stated.**

Several brands of commercial lime-sulphur were tried and in all cases gave good results. The commercial preparations were received in small ½-gallon to 4-gallon containers.

The 1919 *Experiments.*—In 1919 the scope of the experiment was widened in order to ascertain whether lime-sulphur diluted to a weaker strength than winter strength would control peach-leaf curl, and to test whether lime-sulphur stored in sealed air-tight drums would retain its efficiency; also to compare the results from Bordeaux mixture and Burgundy mixture with the results from lime-sulphur. Formaldehyde was also to be tested, but owing to there being no outbreak of peach-leaf curl no results were obtained.

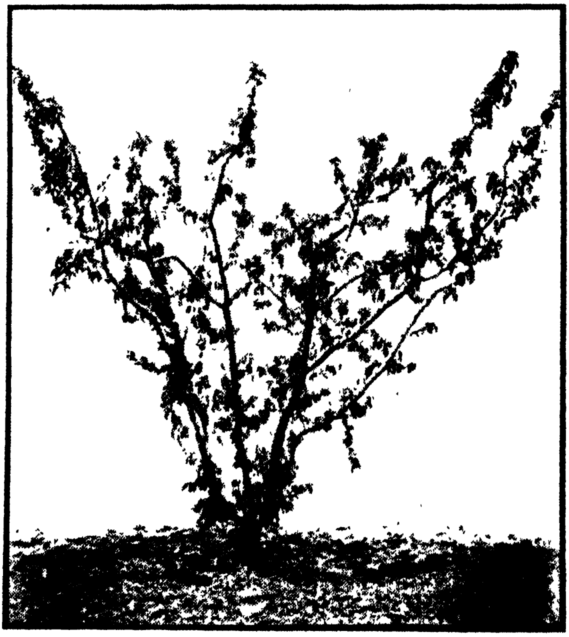
A Healthy Peach Tree at Yanco Experiment Farm.
Sprayed on 5th July, for the control of peach leaf curl.

The 1920 *Experiments.*—In 1920 this extended experiment was repeated, but again owing to the absence of peach-leaf curl in any of the plots or on the unsprayed check trees no results were obtained.

The 1921 Experiments.

In 1921 experiments were again carried out on Elberta peach trees. The treatment of the different plots is shown in the following tables :—

Plot.	Number of trees.	Period of Application.	Spray used.
1	8	When trees dormant.	Lime-sulphur, made the previous season and stored in sealed tins. Diluted 1 part to 7 parts water.
2	1	,,	Formalin, 1¼ oz. to 1 gallon water, and dusted with flowers of sulphur.
3	1	,,	Dusted with flowers of sulphur.
4	4	,,	Freshly made lime-sulphur, diluted 1 part to 7 parts water.
5	8	,,	Lime-sulphur, made previous season and stored in sealed tins. Diluted 1 part to 10 parts water.
6	4	,,	Check trees. Received no spray
7	4	,,	Bordeaux mixture, 6-4-22.
8	4	,,	Burgundy mixture, 4-6-22.
9	4	,,	Lime-sulphur, freshly made, diluted 1 part to 10 parts water.
10	4	,,	Lime-sulphur, freshly made, diluted 1 part to 12 parts water.
11	3	When dormant, (12th July).	A proprietary substitute for lime-sulphur, diluted 14 lb. to 50 gallons water.
12	4	When buds were well swollen, 5th August.	Lime-sulphur, freshly made, diluted 1 part to 7 parts water.
13	2	,,	Lime-sulphur, made 5th July, 1921, and protected with oil on surface Diluted 1 part to 7 parts water.
14	2	When buds were well swollen, 8th August.	A proprietary substitute for Bordeaux mixture, using 4 lb. with 4 lb lime to 50 gallons water.
15	2	,,	Burgundy mixture, 4-6-22.
16	2	,,	Lime-sulphur, freshly made, diluted 1 part to 10 parts water.
17	2	When buds were well swollen, 6th August.	Bordeaux mixture 6-4-22.
18	2	When buds were well swollen, 8th August	Same spray as Plot 11.
19	2	When buds were well swollen, 5th August.	Lime sulphur, freshly made, diluted 1 part to 12 parts water.



Peach Tree at Yanco Experiment Farm, affected with Leaf Curl.

This tree was in the same block as that shown on page 443, but received no treatment for the control of the disease. The two photographs were taken on the same day.

Results.

The treatment shown above, with the exception of the dusting with flowers of sulphur, gave equally good control over peach curl, independent of whether the period of treatment was when the trees were dormant or when the buds were swollen—a feature of the 1921 results, and an experience contrary to that of previous seasons. Some of the terminals of the main leaders showed a few diseased leaves but not sufficient to be harmful. In fact, all the trees in all the plots except Plots 3 and 6 could be classed as clean. Plot 3 (dusted with sulphur) and all the trees in Plot 6 (untreated) were badly affected, fully 75 per cent. of the foliage being diseased.

This year's results point to the possibility of weaker dilutions than "winter strength" lime-sulphur being effective in the control of peach curl. If this turns out to be the case it would mean a decided saving in material, but it would be very unwise to trust to the weaker strengths until such have been proved over several seasons in which the disease is serious elsewhere. It must be remembered also that lime-sulphur is often applied for the dual purpose of control of San José scale and peach-leaf curl, and there is no evidence at present that the weaker strengths are sufficient to control the first named insect pest.

In reference to the diluting of lime-sulphur solution, to produce various strengths, it should be remembered that the solution varies according to the strength of the stock solution used. For instance, lime-sulphur prepared according to the departmental formula generally registers about 25 degrees Baumé, and, according to the table, to dilute 1 gallon of 25 degrees Baumé lime-sulphur to winter strength requires the addition of 7 gallons 2 pints of water, or practically one volume to seven volumes of water. Many of the commercial lime-sulphur solutions, on the other hand, register 32 degrees Baumé, and if this density is produced by the proper combining of lime, sulphur, and water, and no other material that will affect the density, has been added, then to produce 1 gallon winter strength to 1 gallon of it, 10 gallons 3 pints of water must be added—practically one volume solution to ten volumes water.

In connection with the stored lime-sulphur, which gave results equal to those obtained from freshly-made lime-sulphur, it should be remembered that either the storage took place in a sealed can, or that the solution was protected by a film of oil. Storing in casks for long periods would probably not be so satisfactory, as the staves above the liquid would shrink and admit air, and this would become more acute the lower the liquid line fell. Moreover, even in hermetically sealed containers more or less air is encaged if the containers are only partially full, and this is liable to react on the lime-sulphur solution. A fresh supply of air is admitted, of course, every time the container is opened. Thus small lots of lime-sulphur carried over in large containers from season to season might fail to give satisfactory results.

Treatment with formaldehyde (1½ oz. to 1 gallon water) followed by dusting with dry sulphur, was recently mentioned by one publication as capable of being used even after disease had broken out. In the trials now under discussion, however, a previously unsprayed check tree that was sprayed and dusted as recommended on 10th October, 1921, after the disease had broken out, derived no apparent benefit from the treatment.

In this treatment (applied either in the dormant or swollen bud stage) it is possible that the formaldehyde was the active agent, but even if (after several trials over "peach-curl seasons") this proves to be the case, and although the formaldehyde spray would be a very easy one to mix, the comparative cost of this and the lime-sulphur treatment would have to be considered, and the fact borne in mind, too, that there is no evidence so far that the formaldehyde would be effective in the control of San José scale.

It should be added that lime-sulphur has proved effective for the control of peach-curl in tests carried out at Glen Innes Experiment Farm, where a cold, wet tableland-climate is experienced.

The Department's recommendation for control of peach curl appears in the publication, Plant Diseases, Leaflet No. 15, "Peach Curl." It is based upon the Department's experience to date, and is still adhered to as follows:—

"A thorough application of fungicide (lime sulphur or Bordeaux mixture, at winter strength), when trees are dormant, preferably not later than July, will prevent from 90 to 95 per cent. of the infection. This early spraying is of the greatest importance; later sprayings are not so beneficial, but may be used when, because of some unavoidable circumstance, the early spraying has been omitted. Applications of lime-sulphur or Bordeaux mixture are liable to cause defoliation of peach and nectarine trees, if applied after the setting of the fruit. In those varieties in which the fruit is not borne terminally, the diseased twigs should be cut back and the prunings burnt."

Pure Seed.

GROWERS RECOMMENDED BY THE DEPARTMENT

THE Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Gramma:—	
American Pear	R. Dyball, jun., Flettwood Bag, Taree.
Peanuts:—	
Chinese	Manager, Experiment Farm, Grafton.
Valencia	Manager, Experiment Farm, Grafton.
White Spanish	Manager, Experiment Farm, Grafton.
Potatoes:—	
Coronation	J. W. Jay, Ben Lomond.
Factor	J. W. Jay, Ben Lomond. J. Piper jun., Llangothlin.
Early Rose	W. E. Frauklin, Lammer Moor, Oberon.
Early Manhattan	B. C. Meek, Hobby's Yards.
Satisfaction	W. E. Franklin, Lammer Moor, Oberon.
Lucerne:—	
Lucerne	R. J. Crosthwaite, Pilca Butta, Leadville.

Another Pest for Wool-growers.

W. F. BLAKELY, Botanical Assistant, Botanic Gardens.

DURING the last four months specimens of one of the North American sand burrs or "burr grasses," *Cenchrus pauciflorus*, has been received for the first time at the National Herbarium for identification from three widely different localities, viz.:—

1. From Stock Inspector Brigg, Narrabri.
2. From Mr. A. H. T. Sherwin, Shire Clerk, Boree Shire, Cudal, Manildra district, who says: "The seed came (it is supposed) in some Sudan grass seed. There was only one small patch on one holding, and it was destroyed."
3. From Mr. E. Ray, Kelso, who says: "It occurs in a very small patch in an area I sowed two years ago with Sudan grass, and last season with a pasture grass mixture. The seed most likely was introduced through this channel. Needless to say, I am taking steps to eradicate it. The ripe seed heads, which are a pale green colour, are exceedingly spiny and attach themselves to one's clothing, and I think it would be a great curse to sheepowners."

There is not the slightest doubt that the "burr grass," if once established in this country, would become a serious menace, similar to Bathurst and Noogoora burrs. It is advisable therefore to destroy it wherever it makes its appearance.

American References.—Agnes Chase, in *Contributions to United States National Herbarium,* Part i, p. 67 (1920), in a revision of the North American species of *Cenchrus,* states that the burr grasses are "annuals or perennials, mostly of sandy or arid soils. The burrs at maturity are readily attached by their barbed spines to passing animals, the seeds thus being widely distributed. In the Caribbean Islands sand burrs have been found attached to the feet and plumage of water birds."

The "Ohio Weed Manual" speaks of it as "this vile weed," and as commonest in sandy soil.

According to Ada Georgia, in her "Manual of Weeds," "the burrs are said to be more difficult to remove from fleeces than any other."

It is altogether a worthless grass, and the prickly involucres are a grievous nuisance wherever it prevails in cultivated ground or about houses.

Eradication.—The advice given in the United States is: "Fire and hand-pulling should go together in destroying it. Waste sandy areas harbouring it should be burnt over annually."

Ada Georgia suggests that "small areas should be hoe-cut, hand-pulled, or burned over before the burrs ripen. A sandy pasture or meadow infected with the weed should be burned over, cultivated, and fertilised before reseeding to better growth. As a waste-land weed, a whole neighbourhood should be interested in its extirpation, because of its habit of making any passing animal or person its carrier to a new field."

Poultry Notes.

JUNE.

JAMES HADLINGTON, Poultry Expert.

THE hatching season is now with us, and poultry farmers will be looking forward with varying degrees of expectancy. To the seasoned poultry farmer working on general practice it will, to a large extent, be a repetition of previous seasons, and he will take the good results with the bad, confident in the expectation that at the end of the season his general average will have been realised. Not so with the novice. Nothing less than good fertility and a maximum percentage of chickens will satisfy him; everything must be plain sailing, with no drawbacks such as are expected by the more experienced operator. This impatience on the part of the beginner usually results in his falling a victim to all the fads and fallacies that attach themselves to artificial incubation as to many other operations in connection with poultry culture. This feature was particularly noticeable last season, and many serious failures followed.

It should be remembered that in the early part of the hatching season some disappointments are inevitable, and the novice will do well to realize this as the more experienced farmer has learned to do; he will find also that the beaten track of universal experience is the safest course. The starter cannot afford to risk failure by attempting experimentation.

Hatching operations, testing of eggs, and artificial incubation generally were dealt with very fully in these notes for June, 1920. It is not proposed to go all over the ground again this month, more especially as that matter has been incorporated in the new edition of "Poultry Farming in New South Wales" now in course of preparation, but, in pursuance of a promise made to readers some months ago that instructions on operating incubators would be given in time for this hatching season, the following may be presented as the main points in operating incubators. They are applicable to practically all types of machines, and should not be departed from without very good reason.

How to Operate an Incubator.

1. *A Sanitary Incubator.*—See that the incubator is in good sanitary condition.

2. *Thermometers.*—Test all thermometers before starting the season, and again later on. It does not follow that because a thermometer runs true one season it will remain so. The instruments are liable to get out of order, hence the necessity for frequent testings. Where a number of thermometers are in use they may be put into a vessel of warm water, at, say, about 106 degrees Fah., and allowed to remain in it until the

temperature recedes a few degrees; if there is any discrepancy in the temperatures registered, it will of course be necessary to find out which are right and which are wrong. If among the number there are only one or two showing variations from the rest it can be generally concluded that the minority are wrong. However, the safest plan is to procure a tested thermometer with which to compare them.

3. *Starting the Hatch.*—When starting an incubator, the temperature should be got up to, and maintained at, 103 degrees for at least twelve hours before the eggs are put in. When the eggs are put in the temperature will fall, and it is best to allow about another twelve hours for the heat to rise to 102, at which point the incubator should be regulated to run steady. It is a mistake to raise the temperature too fast. If a lamp machine is in use, the lamp should be kept quite clean and the wick free from incrustation.

4. *Eggs.*—Fresh eggs under a week old, and from physically strong stock, are necessary to ensure successful hatching.

5. *Operating*—Before starting the incubator see that the regulating device is in perfect working order.

6. *Temperature.*—Bring the temperature in the incubator up to 102 degrees; this should be raised another degree as the hatch progresses. Between 102 and 103 degrees is the best temperature to run at, leaning to the high side towards the end of the hatch. When the first egg is seen to be chipped, which may occur on the 19th day if the eggs be fresh, let the temperature run up to 104 to 105 degrees until the hatch is finished. For these temperatures the bulb of the thermometer should stand just clear of the eggs; half an inch above is a good position.

7. *Turning.*—Commence to turn the eggs when they have been in the machine thirty-six hours, and turn them at least twice daily up to the ninth day; once per day afterwards is all that is absolutely necessary. Stop turning when the first egg is seen to be chipped.

8. *Testing.*—The eggs should be tested about the sixth day; at that time even a novice can generally pick out the infertile eggs with a good tester.

9. *Cooling.*—Commence cooling the eggs for a few minutes once per day after the sixth day, and gradually increase the time of cooling as the hatch progresses—first to ten minutes, then to fifteen, and up to twenty or even thirty minutes, according to the temperature of the room. But eggs should not be cooled for thirty minutes as a regular thing or too often. Cooling should be stopped when the first egg is chipped.

10. *Ventilation.*—Little if any ventilation is required up to the time of commencing to cool about the sixth day. A graduated amount of ventilation may then be allowed up to the time the first egg is chipped, when the ventilators are better nearly closed. Most incubators are over-ventilated. Experience proves that applied moisture is unnecessary, and in many cases harmful, and most large operators dispense with it altogether.

If eggs will not hatch with incubators operated on these lines it is unlikely that they will do so when such universal practice is departed from. Rather should the operator look in some other direction for the cause of it, and also make quite sure that the machine is really being operated on the lines laid down.

Overhaul the Incubators.

No matter how well incubators may have worked in the previous hatching season, they should be given a thorough overhaul before being put in commission again. The want of such an overhaul is often responsible for some bad hatches before the discovery is made that the incubator is out of order. The parts of an incubator most likely to get out of order are (1) the diaphragm, and (2) the regulation device.

The diaphragm in most hot air incubators is the division between the heating chamber and the egg tray; it usually consists of hessian, calico, or felt tightly stretched. The function of the diaphragm is to diffuse the hot air, so that it is evenly distributed in the egg chambers. If it becomes deranged or perforated, as is often the case, by mice, rats, moths, &c., or in any other way, the machine will not hatch satisfactorily if at all, according to the extent of the damage.

Again, in old machines there is very often an accumulation of fluff from numerous hatchings that will prevent the proper functions of this somewhat insignificant looking but most important part of the machine. Therefore, when using old incubators this part should receive attention and be cleared of any such obstruction.

Regulating Devices.

The temperature-regulating part of the machine should also receive special attention. If a capsule is the expanding device in use, then it is necessary to see that the chemicals (ether and alcohol) with which it is charged have not leaked out and rendered it useless for expansion. This of course is the mechanism for raising the regulating arm.

The capsule can be tested by the application of heat, a lighted match held under it being a favorite and simple method among poultry-farmers. If the capsule is in good order it will be seen to expand gradually. Close observation is necessary to see the expansion, for it takes place almost imperceptibly, and the test must not be overdone or the capsule will burst.

If a thermostat is the device used for the same purpose, it will be necessary to see that it is not broken, bent, or otherwise out of order.

The regulating arm or rod on top of the machine, running from the pin connecting with the capsule or thermostat, as the case may be, may be so bent as to be incapable of properly transferring the regulation to the damper or sleeve, whichever is in use. Again, the rod connecting with the capsule or thermostat may be bent, in which case friction on the side of the aperture through which it connects with the arm will prevent it from functioning properly.

Thus it will be seen how very necessary it is that all these parts be inspected and adjusted prior to commencement of hatching.

Disinfecting Incubators.

It is necessary that the incubator be in good sanitary condition to start with. If ordinary care has been taken during the previous use of the machine, it should not be in an insanitary condition so far as excreta and such like adherents are concerned, except perhaps the moveable portions, such as the tray or bottom diaphragm, which may be washed in some disinfectant. It is not a good plan to wash or spray the main portion of the machine, disinfecting of this being better accomplished by fumigation. The best way to fumigate is to place a pinch of permanganate of potash in a bowl or saucer, and pour over it sufficient formalin to wet it. This will cause fumes that are a most powerful disinfectant. The incubator should be shut up immediately so as to confine the fumes. *The operator should take great care not to inhale the fumes.*

Don't Aim Too High.

Success in poultry-keeping does not depend entirely upon numbers. Experience shows that while one man will make a living from 600 or 700 head of layers, another will go to the bad with a stock of 1000. Then, again, it is well to remember that 1,000 layers and the raising of the necessary number of pullets each year to replace half of them, is more than a one-man job, yet each hatching season there is a kind of chicken-hunger that will not be appeased until the season is over.

Some of the biggest efforts made in rearing chickens are responsible for the greatest failures. And why? Because the numbers hatched are beyond the capacity of the rearing equipment, and sometimes of the farmer. It is safe to say that hundreds of thousands of chickens are lost annually as a result of over hatchings.

A PROBLEM IN AGRICULTURAL DEVELOPMENT.

IT is generally recognised that one of the problems demanding special attention at this time is that of short-time personal credit for farmers. In the case of a man who has paid for his farm, the supplying of personal credit raises, as a rule, no serious question. In the case of the renter, however, and of the young farmer who is just starting out as an owner, the question of short-time credit is a difficult one. In such cases credit can and should be based, to a considerable extent, upon character and productive ability. To deny credit to the honest, ambitious and energetic farmer because he has little tangible security to offer is to lessen the productivity of available capital, and to discourage a man who, in the future, should be a land owning farmer. While the bankers are in many cases showing a commendable interest, the need is for a system which will enable the man without collateral to secure funds for productive agricultural enterprises. Without doubt this important problem should receive careful consideration, and every feasible effort should be made to aid the farmer in obtaining the necessary personal credit.—The 1920 Year Book of the United States Department of Agriculture.

Viticultural Notes for June.

H. L. MANUEL, Viticultural Expert.

VINTAGE work has ceased for some time now, and many vignerons who have not previously done so will be going through their young wines, scanning them with regard to future blending, topping up on secondary fortification of young sweets and sherries, &c.

For the benefit of those doing their first season's wine-making, it may be appropriate to remind them of the necessity for racking young wines towards the end of this month. By the word "racking" is meant running off from one cask and placing the wine in another, the chief object being to remove the wine from the deposit known as lees. When a young wine enters the cask it has in suspension particles of skin, pulp, seed, earth, dead yeast cells, and other organic and inorganic matter, besides various salts which are in a state of more or less insolubility. These substances gradually gravitate to the bottom of the cask, and by end of June the young wine appears more or less bright. If left on the lees, however, there is a danger of the organic matter contained in them undergoing putrification, and the wine consequently becoming unsound.

In racking a cask, care should be taken not to disturb the lees; in dealing with small casks syphoning is best resorted to, drawing off just above the deposit.

A word of warning here may be given as to the use of fresh casks. Before making use of such a cask be careful to see that it is thoroughly clean and free from any foreign smell—mustiness, acetic, &c.

In handling dry wines do not take any risk by leaving them on ullage. Keep the casks full. It may be as well to make a practice of filling them off weekly. By leaving an air space, particularly in the case of very light dry wines, there is always the danger of acetic trouble coming about.

The Vineyard Itself.

With vineyards that it is intended to trellis, it is always advisable to start early in the year with the work, preferably the autumn. This is the more convenient time and allows for work to be completed before the spring. By carrying the work into the spring months, there is always danger of injuring the young buds. Trellising is better not left until the vines are in their third and fourth years, as happens in many cases. It is far better to complete the work during the second year from planting. A vine not trellised until the third and fourth years cannot be satisfactorily formed and trained, and one sees in many cases uneven crowns and unsightly angles of stems the result of such delay.

In soils other than those of very loose nature, subsoiling should be started and completed as soon as possible, and on completion the soil can be worked down so as to be in readiness for pegging out and planting at some near future date.

In most districts the pruning of the vines has already been started. Very early pruning cannot be generally recommended, though on large holdings, in order to get through the work in good time, there is no alternative but to start early in the season.

A word or two on pruning shears will not be out of place. The impression entertained by the average person is that as long as a shear is called a pruning shear it is fit to do the work with. This is a great mistake. It pays to procure the best article and to keep it in good order. The extra expense in purchasing a good pair of shears is soon made up in quicker and better work.

With various cheap nondescript types of shears, such as one comes across so often nowadays, it is impossible to do satisfactory work.

A close fitting pair of shears will do clean work, and a blade free from shoulder is easier on the wrist and does not injure the wood by splitting and bruising, as the abnormally shouldered blade does.

While mentioning pruning it may be well to remind those intending to spring graft, that they should put aside the cuttings they are likely to require. A fairly dry sand heap makes a good "heeling-in" bed. When cuttings are placed in bundles, see that the sand is allowed to get well through them, so that there shall be no air spaces in which the wood can dry out.

MONEY IN OSTRICHES.

OSTRICH feathers are now very much in demand for decorative purposes in many different forms of use, and indications point toward a considerable rise in prices within the next 12 months. During the past six years of slump in ostrich feathers, many farmers have taken practically no interest in their birds, and there are now only about one-half the number of ostriches in South Africa there were in 1913. In view of this, the *Journal* of the South African Department of Agriculture says, farmers would be well advised to collect what birds they still have and to fatten them up in anticipation of the coming breeding season.

HITHERTO many of the alert and intelligent boys and girls of the countryside have found the life of the farm monotonous and irksome, and they have drifted to the towns and to other industries, where their natural vigour and abundant energy have won them great success. Many of them might have been saved for country life had they been given from the outset their own little plot of land and their own animals; they could then taste the very real joys of rightful possession, and not have to drift elsewhere to seek them. —Sir ARTHUR GRIFFITH-BOSCAWEN, Minister of Agriculture, England.

Orchard Notes.

JUNE.

W. J. ALLEN and W. LE GAY BRERETON.

WHERE deciduous fruit trees or vines are to be planted this season, it is best to start the work as early as possible, whether it be for refills in an established orchard, or for the planting of a new orchard. The sooner now that any planting is finished the better, provided the soil is in good condition, as the early root growth, which starts long before the trees shoot in the spring, has an opportunity of doing so in the permanent position, whereas if planting be delayed this takes place in the nursery and is wasted when the tree is transplanted later.

If the soil be too dry, however, it would be better to defer the planting until after more rain falls, but wherever there is sufficient moisture this work should be pushed on to completion.

Plant only such varieties as have proved themselves suitable to the district, and, as a general rule, it is wise to restrict the selection to a limited number of varieties, as, except under special conditions, it is advantageous to put a few big lines on the market rather than a great many small lines. Where there are old growers in the district, it is well to be guided by them as to what they consider the best varieties of the best kinds of fruit to plant.

Inter-pollination.

There are many instances where large blocks of one variety of fruit have been planted, and the crops have not been as consistently heavy as when the same variety is growing under similar conditions, except that there was provision for inter-pollination.

There is also local evidence that a variety may be self-sterile in one district and self-fertile in another, and it is not at all unlikely that, though a variety in a certain district may be self-fertile for several seasons, it may then become self-sterile. It is in the light-crop or off season that the effect of cross-pollination becomes very apparent, and it is in the off season that the crop is generally most valuable.

For the above reasons planting of one variety in large blocks should be avoided. If the varieties are planted in pairs of rows only, they are just as easily worked as in blocks, and if two varieties of the same kind of fruit whose blossoming periods coincide are chosen, or at any rate overlap, better provision is made for cross-pollination. For instance, if Granny Smith and Jonathan are the apples to be planted, plant two rows of the former and two rows of the latter, and so on.

The need for cross-pollination has been more emphasised in the case of apples and pears, but it is also apparent in some varieties of both European and Japanese plums, and the safest plan when planting any deciduous fruits is to provide for cross-pollination.

Pruning.

In deciduous orchards pruning will be occupying the attention of the orchardist this month.

With young trees up to three or four years old, the work is chiefly confined to forming the tree, and great care should be exercised in choosing the best leaders for the future framework, the remaining leaders and other strong growths that are not required, being entirely removed. In apples that are liable to woolly aphis, it is most important not to leave any strong growths that will not be required for the future framework, as they will have to be removed in later years, necessitating a heavy cut that will take some years to callous over, during which time the wound will be a constant breeding place for woolly aphis. If on the other hand, the same wood is taken out as yearling shoot, it will very quickly heal over and give no trouble.

For the first three or four years it is generally necessary, also, to top back the main leaders rather heavily. But when the lower part of the framework of the tree is sufficiently established and stocky enough to stand it, and while the tree is still making strong growth, the leaders may be thinned out only and not topped back.

When pruning it should be remembered that peaches crop only on the previous year's growth, and the older wood will not retain a permanent self-replacing spur like the apple or pear.

The European plum mostly crops on spurs on two-year wood or older. With some varieties this spur can be relied on for several seasons, whereas in others, such as President and Grand Duke, they often die out after cropping once, and it is necessary to provide for frequent renewals of the spurs. In most varieties the yearling lateral must be given plenty of length to allow it to develop spurs. The Japanese plum often crops on the yearling lateral like the peach, but also spurs very readily on the two-year-old wood.

With very few exceptions the self-replacing spurs on the two year or older wood of apples and pears is relied upon to give the crop. As these trees increase in age the spur system often becomes too multiplied, and it is necessary to thin them out. In doing this work care should be exercised that, besides leaving sufficient good, plump spurs for the ensuing crop, a supply of partially formed smaller spurs is left, which will develop during the season into plump spurs for the year after.

It is during pruning that an orchardist has an opportunity of inspecting every part of each tree, and a close watch should be kept for any fungus disease or insect pest which is attacking the wood, such as canker or scales and such trees marked for treatment at the right time.

Cultivation.

Where orchards have not received an autumn ploughing, or are carrying either a sown or weed crop, the winter ploughing should be started in time to have it completed not later than the end of July.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1922.

Society.	Secretary.	Date.
Warren P. and A. Association	A. C. Tompon	June 7, 8
Hay P. and A. Association (Sheep Show)	C. L. Lincolne	July 12
Parkes P., A., and H. Association	J. Heel	Aug. 15, 16
Forbes P., A., and H. Association	E. A. Austen	,, 21, 22, 23
Murrumbidgee P. and A. Association (Wagga)	A. F. D. White	,, 22, 23, 24
Corowa P. A. and H. Society	J. D. Fraser	,, 29, 30
Grenfell P. A. and H. Association	G. Cousins	,, 29, 30
Gunnedah P. A. and H. Association	M. C. Tweedie	,, 29, 30, 31
Junee P. A. and I. Association	T. C. Humphreys.	Sept. 5, 6
Young P. and A. Association	T. A. Tester	,, 5, 6, 7
Northern A. Association (Singleton)	J. T. McMahon	,, 7, 8, 9
Hills District Fruitgrowers' Association (Galston)	B. F. Renant	,, 8, 9
Cootamundra A. P. H. and I. Association	Wm. A. Sowter	,, 12, 13
Cowra P. A. and H. Association	E. P. Todhunter	,, 12, 13
Albury and Border A and H. Society	A. G. Young	,, 12, 13, 14
Holbrook P. A. and H. Society	Jas. S. Stewart	,, 19, 20
Temora P. A. H. and I. Association	A. D. Ness	,, 19, 20, 21
Murrumburrah P. A. and I. Association	W. Worner	,, 26, 27
Narrandera P. and A. Association	W. H. Canton	,, 27, 28
Ganmain A. and P. Association	A. R. Lhuede	,, 12, 13
Hay P. and A. Association	C. L. Lincolne	Oct. 4, 5
Berrigan A. and H. Society	R. Wardrop	,, 10

1923.

Society.	Secretary.	Date.
Kiama Agricultural Society	G. A. Somerville	Jan. 25, 26
West Bargo A. H. and I. Society	L. J. C. Hicks	,, 26
Newcastle A. H. and I. Association	E. J. Dann	Feb. 27, 28, Mar. 1, 2, 3
Central New England P. & A. Assoc. (Glen Innes)	Geo. A. Priest	,, 6, 7, 8

A MITE THAT ATTACKS FRUIT TREES.

VERY commonly at this time of the year one sees upon the bark of apple trees the pink patches caused by the bright crimson eggs and young larvæ of the Red Apple Mite (*Byrobia pratensis*). Though very abundant at times (particularly in the Bathurst and Orange districts, where they often cover the sticks and stones under the trees as well as the trunks), they do not seem to do a great deal of harm, probably because they appear early in the winter, subsequent storms destroying a very large number of them. In a mild season, however, these mites have a habit of getting on to the young leaf buds, where they do a considerable amount of damage, as they suck up the sap from the trees. It is advisable, therefore, to spray any badly-infested trees with lime-sulphur—the earlier, now, the better, the object being to catch the young mites as they emerge from the eggs.—W. W. FROGGATT, Government Entomologist.

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Agricultural Gazette of New South Wales.

Sheep on the Wheat Farm.

A. H. E. McDONALD, Chief Inspector of Agriculture.

SHEEP must be regarded as an indispensable factor on the wheat farm. They are valuable as part of the working plant of the farm for the control of weeds, &c., and as an important and reliable source of income.

While, as a general practice, the use of agricultural land for sheep-raising is unprofitable, if due consideration is given to questions of interest and other items of a like nature, it cannot be taken as a hard and fast rule, as the indirect value of the sheep is frequently of greater importance than the cash return. It is essential to the success of the crop that the farmer have on his holding as many sheep as possible, compatible with the most economical use of the land for wheat production.

Sheep are useful and valuable on the following grounds:—

1. They consume and turn to profit the straw left after the harvest.
2. They turn weeds to profit and prevent them from seeding at times when the farmer is unable to deal with them, owing to pressure of other work.
3. Their manure improves the fertility of the land.
4. When the season is so bad that the crops fail to produce grain, sheep turn them to profitable account.
5. The income from the farm is rendered more certain, as the farmer does not then depend entirely upon a crop that may be destroyed by fire or hail.
6. Sheep necessitate the adoption of a rotation, which tends to improve the fertility of the land, and to increase the yields of the crops.
7. They can be used to feed off crops that need such a check.
8. A supply of cheap mutton is made available for the farmer's own household.

To these advantages might be added the pride and pleasure derived by a farmer from the possession of a good flock.

The Number to Carry.

The number of sheep that can be carried on a wheat-farm varies according to the class of soil, climate, and the farming system adopted. If the sheep are regarded purely as an adjunct to wheat-growing, and are kept principally for scavenging, then the number must be strictly limited. If, on the other hand, a farmer regards lamb-raising as an important part of his enterprise, and makes provision for the growing of crops solely for sheep-feed, then the number may be very considerably increased. Some who adopt the latter practice carry as many as one and a half sheep to the acre, and still grow a considerable quantity of wheat.

In districts with a distinctly summer rainfall, particularly the north-western portion of the State, it is doubtful whether it is a sound policy for farmers to endeavour to grow wheat as the main source of their income. Some have already realised that their income is more assured when sheep take an important place in the farm operations. A very great deal of the land in the north-western districts suitable for wheat is not good land for the carrying of sheep in its natural state, but it is immensely improved by cultivation, and after being used for wheat for a few seasons it makes splendid grazing land. Further, Sudan grass and lucerne both thrive well there. The value of the latter is well known, and it needs no recommendation. A number of practical farmers are now extensively growing Sudan grass solely for the fattening of lambs, and are getting excellent returns.

In the north-west, and in other districts to a lesser extent, rain very frequently falls during the summer months, but fails during the wheat-growing season. Where wheat alone is relied upon the year's income is partly or wholly lost in a dry season, but where sheep have a prominent place on the farm a failing crop can be profitably utilised by turning the flock in. The summer rains, on the other hand, produce an abundance of feed, particularly if Sudan grass or a similar crop has been sown.

In the past it has usually been taken for granted—as a result of habits formed during our long pastoral history—that sheep should be turned out into the grass paddocks for their living. Such traditions are, however, now dying, and many practical farmers are producing crops to increase the carrying capacity of their land.

Such crops are valuable in several respects. Sown crops invariably make quicker and greater growth than natural herbage, even under the most favourable conditions. This indicates that some crop should be grown to produce succulent green feed for lambs about April or May. Such feed promotes the rapid development of the lamb by increasing the milk flow of the mother, and results in the early maturity of a first-class lamb.

The growing of fodder crops is of great value, inasmuch that a large quantity of feed is produced on a small acreage. On a good crop of oats, barley, or wheat, from ten to twenty sheep can be carried per acre for a lengthy period in the spring. It is just at this period that the summer herbage is sprouting. If heavily stocked at that stage, the young grass is eaten off as quickly as it sprouts, and is prevented from making a strong growth. Where a crop is available on which the sheep can be kept at this period, the grass can be protected until it has made a good growth, and a heavy body of feed is thus provided that will carry sheep through the summer. Even on purely grazing properties it is found that the carrying capacity can be largely increased if the sheep can be kept off the grass at this period.

Sheep are particularly valuable in controlling weeds, especially wild oats. It frequently happens during spring that the oats cannot be entirely destroyed. Even on the best-worked farms wet weather may prevent their complete destruction. The farmer finds the haymaking at hand, and his only possible means of preventing the oats on his fallow land from seeding is to graze them off with sheep. When the returns from the sheep are being taken into account due credit should be given for these indirect benefits.

Fallowing in Relation to Sheep.

The value of fallowing is now recognised by all capable farmers. Fallowing, however, can only give the best returns when combined with sheep, and it actually provides the opportunities for keeping sheep. Where fallowing is not practised the straw is burnt off and the land is ploughed for the succeeding crop, but under a fallowing system it is not necessary to burn the straw, for the stubble can be grazed with sheep six or seven months after harvest. A great deal of the straw is eaten, and the balance is broken and trampled into the ground, and is generally put into such a state that it can be ploughed under easily without the texture of the land being interfered with.

In the Old World great value is attached to farmyard manure, the basis of which is straw. It is not yet possible, in this country of high labour costs, to adopt reaping and threshing and the production of farmyard manure for the maintenance of soil fertility. The grazing of sheep on the straw and the ploughing under of the residues, however, is a very fair substitute, and has the advantage, which appeals to all of us, of being applicable at no outlay for labour.

A very undesirable feature of farming in our wheat districts is its one-crop nature Such a system tends to deplete the fertility of the land, and to encourage weeds and diseases. Some of these—namely, wild oats among the weeds, and take-all among the diseases—levy very heavy toll upon our crops, and the only practicable method of dealing with them is by rotation. In practically all the wheat districts, wheat is the only saleable crop which can be raised; but oats, barley, Sudan grass, and others can be grown as fodder crops and can be turned to account by means of sheep. By the use, therefore, of sheep, we can apply one of the great principles of good farming—rotation of crops.

Perhaps the chief reason that more sheep are not kept by many farmers is that the area under crop must then be restricted. Under our conditions any year may be a winning year—that is, the weather conditions may be so favourable that very heavy yields may be obtained from even the worst prepared land. This reason operated to a very great extent in the early development of wheat-growing, and still prevails in many newly-opened districts, but in the settled districts very many capable farmers have realised the value of adopting sound systems of mixed farming, which give sure and satisfactory returns.

It is very rarely that a crop fails entirely, but it does happen in our worst years, such as 1914 and 1919, that the crop fails for grain. In such years a growth is produced which, by the use of sheep, can be converted into wool and mutton, and made to give a very fair return.

The number and class of sheep which can be carried upon the farm depend upon the soil, climate, &c. In reaching a decision, other points should be taken into consideration—first, the cash return from the sheep, and second, the indirect return in the shape of heavier crop yields resulting from the greater fertility of the soil that results from grazing with sheep.

In the Riverina and central west, where the conditions are favourable for the production of wheat, the number of sheep carried on a farm would be the number required to keep the fallows in clean condition, and to enable the stubble to be turned to good account. A fair amount of feed is available from December to June, but natural herbage is generally short during the balance of the year, owing to most of the land being under fallow or in crop. A few acres of oats or barley should be grown to provide feed at this time. Such crops are particularly valuable for topping off the lambs

In the northern portion of the western district and to a greater extent in the northern districts, the climatic conditions are not so favourable for the production of wheat. The rainfall largely falls during the summer months, and the wheat-growing season is frequently so dry that the growth of the crop is affected. On the other hand, it happens not infrequently that the winter and spring are abnormally wet, and the yield suffers by lodging or by the attacks of rust.

While in this part of the State a large part of the annual rainfall occurs during the summer, it is not excepting in one or two districts, sufficient for the production of summer crops for sale off the farm, such as maize, but it is sufficient for Sudan grass and for grazing lucerne. As the wheat crop is risky, it is evident that to stabilise the returns greater attention should be given to sheep, particularly the raising of fat lambs Where the rainfall is so heavy as in the north-west— about 25 inches per annum— the carrying capacity of the farm is fairly heavy when fodder crops are grown. These latter are essential, for, as indicated previously, much of the land is not of good grazing quality in its natural condition, although when allowed to run to grass after cropping it improves very considerably.

Fodder Crops Essential to Best Results.

Farmers who have not had experience in raising fat lambs on crops look askance at suggestions of growing fodder crops, but those who have had experience and who have a good class of ewe, joining them with good rams, find the returns compare very favourably with those from wheat. It must be remembered that risks are avoided, and that the expenses of sacks and of harvesting are not incurred.

In the first districts mentioned, namely, those in the Riverina and the southern portion of the west, about 150 to 200 ewes can be kept on farms of about 600 acres. These could be carried principally on the stubble and fallows, with a little grass land. It would be necessary to provide some fodder to supplement the small amount of herbage on the fallows in the spring and early summer. For this purpose, a few acres, say, 20 or 30, of early-sown oats, would be sufficient. In some places in these districts summer crops cannot be successfully grown; but in some, Sudan grass grows reasonably well, and a small acreage should be sown.

In the northern districts the farmer should, on account of the somewhat risky nature of wheat-growing, definitely make lamb-raising an important part of his operations. On a 600-acre farm about 300 or 400 good ewes should be kept and fat lambs raised. This may appear a large number, and it would only be possible to keep so many by growing fairly large areas of fodder crops; but the climate is suitable for the production of these. and in the winter months oats and barley can be provided, while during the summer Sudan grass gives good feed and lucerne will also provide valuable grazing.

On every farm where sheep are kept a good reserve of pit silage should be held. Silage can be made easily and cheaply in the pit, and keeps indefinitely. It should be regarded as a reserve for dry years only, and therefore need not be made every year. Indeed, it would probably be found that the silage would remain in the pit for years, but the possession of it enables a farmer to keep up his carrying capacity, as he is not confronted with the danger of shortage of feed.

The Class of Sheep to Keep.

The lines along which the farmer shall work in the handling of his flock require a little consideration. Mr. F. B. Hinton, Sheep and Wool Expert, has pointed out that three avenues of direct profit from sheep are open to the farmer :- (1) He may confine himself to wool production, or (2) he may produce both wool and mutton, or (3) he may devote special attention to the production of lambs.

With regard to the first of these three, the mixed farmer is at a disadvantage compared with the larger grazier. The latter has cleaner pastures and is able to produce a class of wool that commands more attention in the wool sale-room, for on the farm the dust from the cultivation paddocks and fallows penetrates the wool and opens it on the back, depreciating the value of the fleece The farmer is, therefore, rather pressed into the second and third ways of earning profits from his sheep. The type of sheep that under most circumstances has proved profitable to the mixed farmer is the crossbred, which principally means the progeny of some longwool English ram with a Merino ewe.

A lot of attention has been devoted by the Department to this phase of the industry, and extensive experiments have been conducted to determine the best breed of ram and the best type of ewe for the purpose. Many English breeds have been tried, but certain ones have gradually been eliminated, until it has narrowed itself down to a contest between the Lincoln and the Border Leicester. Of the two, the latter shows slightly to advantage, although for certain districts the Lincoln is undoubtedly the better. Some of the Down breeds were also tried in this connection, but they failed to "nick" well with the Merino in the first cross. The class of ewe most suitable for mating with these British rams has been found to be a large-framed, plain-bodied, robust and roomy type of Merino ewe. The crossbred thus obtained gives a heavy weight of fleece and is always in ready demand as a mutton animal, whether for local consumption or for export as frozen mutton.

The third line of profit open to the mixed farmer is that of raising fat lambs. This is an industry that commends itself to farmers owing to the quick returns it furnishes, for it involves the marketing of the lambs straight off the mothers at the age of 16 to 20 weeks. The requirements of the trade are an animal that, as a dressed carcase, will run from 35 to 40 lb. and at the same time have the sappy, luscious flesh that belongs to lambs.

For fat lamb production certain things are essential, viz., the farm must be within easy distance of the railway, a supply of feed must be ensured for the ewes, and a combination of breeds must be used in order to ensure that the lambs grow quickly. Extensive experiments have been carried out by the Department in this direction, with the object of finding the best combination of breeds to produce early lambs, and it is here that the Down breeds showed their usefulness. Representatives of practically every Down breed (Southdown, Shropshire, Hampshire, Oxford, &c., and the Dorset Horn) were tried, being mated with first-cross ewes from the longwool crosses already referred to. At the conclusion of the experiments, the three breeds which showed out ahead of the others were the Dorset Horn, Southdown, and Shropshire, in the order named. The Dorset Horn proved itself pre-eminently suited for the production of early lambs. Working on these lines, the farmer gets approximately 25s. per head for the lambs, and n the vicinity of 10s. each for the ewes' fleeces.

The class of farming thus outlined commends itself to the wheat farmer—firstly, by reason of the quick returns; and secondly, because the sheep can be utilised for cleaning up the fallows and cultivation, and for feeding down crops when necessary. The farmer must ensure a supply of green feed for the ewes during and after lambing, in order that there may be a constant flow of milk for the lambs, which must not suffer any check or set-back from birth to marketing.

Handling the Flock.

Reverting to the subject of the ram most suitable for farmers' purposes, it must be remarked that unfortunately many farmers are content to use almost any breed of ram, and in many cases the crossbred has become a nondescript animal. It should always be remembered that a poor type of lamb costs as much to keep and as much to market as a high-class one, while the difference in price will amount to many shillings. Similarly, a poor type of ewe costs as much to keep as a good one, but will breed only a poor lamb and give half the weight of poor quality fleece.

It may cost a little more to buy a good line of ewes or a few good rams, but the extra outlay is amply justified by the return in wool and progeny.

The ewes should not be kept after their mouths begin to break. Old ewes certainly make good mothers, but they give a poor fleece of low weight, and furthermore, do not thrive in dry times, and they generally die early in drought periods. When they are becoming aged the first opportunity should be taken to fatten and sell them.

Success in lamb-raising depends very largely upon successful mating. In some cases this may be difficult to secure, but as a rule it should be arranged to commence towards the middle of April, about which time good green feed should be available. At an earlier period the pastures would probably not be in the autumn flush. The ewes should be in good condition at the mating time, but not too fat. It assists if the ewes can be put on some good green feed about a fortnight before mating.

The rams should be in good, strong, vigorous condition, and to obtain good results two rams should be used to every 100 ewes. If they show a disinclination to work, the ewes and rams should be yarded together at night.

Sheep are very fastidious in regard to water, and should always be provided with good fresh water. If dirty, they will only drink with reluctance, and as ample water, particularly when they are on dry feed, is essential, they should drink abundantly. It is, therefore, an advantage to pump water from dams or tanks, and to keep the drinking troughs scrupulously clean.

A MEDICINAL WATER.

A SAMPLE of water taken from a creek in the Carcoar district came under analysis lately, the result being as follows:—

	Parts per 100,000.	Grains per gallon.
Total solid residue	240·0	168·0
Saline residue	195·4	133·5
Loss on ignition	44·6	34·5
Chlorine	17·5	11·9
Equal to sodium chloride (common salt) ...	27·0	18·9
Alkalinity calculated as carbonate of soda ...	4·2	2·9
Magnesia calculated as magnesium sulphate ...	174·0	121·7

The sample was turbid, but settled clear on standing, odourless, of a saline taste, and the residue contained sulphates, magnesium, with smaller quantities of lime.

The water was remarkable for the very high proportion of magnesium sulphate (Epsom salts), the presence of which in such a large quantity would bring the water into the class of medicinal waters, having purgative properties.—F. B. GUTHRIE.

Field Experiment with Maize.

WOLLONGBAR EXPERIMENT FARM.

J. DOUGLASS, **Experimentalist.**

AN experiment was conducted at this farm last summer with the object of testing graded as against ungraded seed for maize fodder purposes, and also to ascertain if any increased yield obtained would justify the more expensive seed.

Only two plots were sown, each being one-seventh of an acre.

The previous crop was wheat for hay in 1921, the stubble from which was ploughed under with mouldboard plough on 10th October, 1921. The soil turned up in good condition and was later worked down with the harrow, being in ideal condition at planting time. Drills four feet apart were struck out, and then seed was sown with a dropper on 28th November. Fitzroy maize from Grafton Experiment Farm was used at the rate of about 20 lb. per acre, 2 cwt. of P7 fertiliser (equal parts of superphosphate and bonedust) being added.

The seed germinated excellently, and the plants showed rapid growth and were ready to cut on 15th March, 1922. Very little difference between the plots was noticed during growth, except that the ungraded maize was rather patchy.

The rainfall during the growing period was :—

December	1,226 points.
January	384 ,,
February	1,939 ,,
March (to 15th)	398 ,,
	3,947 points.

The maize produced excellent green fodder, and was the best crop on the farm. The results were :—

Graded seed	15 tons 4 cwt. 3 qrs. per acre.
Ungraded seed ...	10 ,, 10 ,, 0 ,,

The value of the increase per acre at 10s. per ton, would be £2 7s. 3d. Allowing 4s. per bushel as the extra cost of the graded seed, the increased cost would only be 1s 5d. per acre.

Judging by the above results, graded seed for fodder crops is undoubtedly a profitable proposition.

WHAT VOLUNTARY LABOUR DID.

BY the voluntary labour of its members, the Wallsend Branch of the Agricultural Bureau has erected a hall 18 feet by 12 feet, in which to hold its meetings. The members each gave one day per week for a month, and had the satisfaction of completing the structure in the month. The sum of £60 has also been raised by various means to purchase the land (about 5¼ acres) and help to pay for the hall. The hall is regarded as a distinct asset locally.

Field Experiments with Oats.

NINE YEARS' RESULTS, 1912 TO 1920.

Glen Innes Experiment Farm.

R. G. DOWNING, B.Sc. (Agr.) and L. G. LITTLE, Experimentalist.

THOUGH this district is so suitable for the growth of oats for hay and grain, yet oats do not occupy the prominent place in the farm practice of the district that wheat does in the wheat belt. The district is suitable for the growth of many crops, and the soil is the chief determining factor as to which particular crop is most suitable and popular for any particular locality.

Maize, potatoes, oats, and wheat are all suitable crops, and in addition to the factor already mentioned their popularity is affected by their market value. Maize is becoming increasingly popular under the influence of good prices; potatoes are *the* crop for potato soils, but oats have a wider range than any other crop.

Where a rotation is carried out on the richer soils oats are sure to be included, and on the poorer soils they are more reliable and consistent than wheat.

Oats hold a larger place in New England agriculture than wheat because of their greater suitability to climatic conditions, and the greater range of suitable soils.

The chief drawback is the liability of the crop to lodge. This liability is greatest in the best crops, and frequently entails considerable loss of grain and hay owing to the extreme difficulty of harvesting. The usual practice is to cut for hay and minimise the risk of loss. The substantial rainfall of the summer interferes with the harvesting of prime samples of hay, but good prices are usually obtainable for New England oaten hay.

When to Sow.

It is possible in most seasons to produce an excellent sample of grain of either white or brown varieties. There is the same scope for varieties for early or late plantings as for wheats, but there is a peculiar difference in the practical application. In growing wheat the practice is to sow early maturing varieties late in the season, and late maturing ones *vice versa.* The practice in the district with regard to oat planting is not the same. Early and midseason varieties give best results when sown not later than midseason. Late varieties will give best yields when sown early, but they also give good results when sown very late in the season and are popularly used for this purpose. This holds good only with regard to hay yields.

Hence White Tartarian is the oat most used for late planting, and there is no data to show any other variety that is more suitable for this purpose. The reason for these conditions is not known, but the spring and summer here are periods of hot sun and comparatively cool soil temperature, which seems to force late-sown varieties into rapid maturity. Hence, the best results are gained from a variety which can withstand these forcing conditions.

Late-sown oat crops are not reliable for grain because of the ravages of rust.

The seasons for planting mentioned above may be outlined as follows:—Early planting, before 15th May: midseason planting, 15th May to 15th July; late planting, 15th July to 15th September.

The results presented in the accompanying figures are mostly from mid-season sowings, and it is possible that better results would have been obtained from earlier sowings of the very late varieties. Only the averages are included of varieties that have been tried for three years or longer.

Grain and Hay Varieties.

Algerian is supreme for grain production, and Guyra for hay. It is varieties of this type which are the best for general purposes. Early maturing varieties are inconsistent in their returns and cannot be relied on for late plantings. The very late, coarse-growing, white oats make a satisfactory hay growth from late plantings, but are very smut liable, and if sown in season make a coarse, flabby growth which lodges easily. They have never given satisfactory grain yields over a period of years, though in odd seasons some excellent crops have been gathered.

The average yield from Algerian (the check variety) is 39½ bushels of grain and over 2 tons of hay, which is satisfactory when it is remembered that two drought periods are included (1915 and 1918–19).

OAT Variety Trials—Nine Years' Results, 1912–20.

Years when Grown.	No. of Years Averaged.	Hay Yields.				Grain Yields.		
		Variety.	Yield per acre based on percentage.			Variety.	Yield per acre based on percentage.	
			t.	ct.	qr.		bal.	lb.
1913–1920... ...	8	Guyra	2	9	3	Algerian	39	18
1918–1920... ...	3	Smyrna	2	4	1	Smyrna	38	34
1912–1917... ...	6	White Ligowo	2	3	0	Glen Innes No. 1.. ...	35	18
1912–1920... ...	9	Algerian	2	3	0	Guyra	35	6
1915–1920... ...	6	Lachlan	2	3	0	Yarran (Bathurst No. 5)...	33	22
1912–1917... ...	6	White Tartarian	2	1	2	Lachlan	32	30
1914–1920... ...	7	Ruakura	2	1	1	Ruakura	31	13
1918–1920... ...	3	Glen Innes No. 1.. ...	2	0	2	Kherson	30	27
1918–1920... ...	3	Yarran (Bathurst No. 5)...	1	19	2	Sunrise	27	22
1912–1917... ...	6	Hutchinson's Potato ...	1	19	0	White Tartarian	27	18
1914–1920... ...	...	Sunrise	1	19	0	Hutchinson's Potato ...	25	32
1912, 1914–20 ...	8	Kherson	1	18	2	White Ligowo	23	16

It might be stated here that it is in a drought period that the New England cerealist gets his best returns. On an average more rain falls than the winter crops ever utilises, and a considerable reduction in the rainfall can occur without much loss to the crop. This is borne out in the records, for only on one occasion (1918) did the yield sink below a ton to the acre. Hence, good profits resulted from the moderate crops of drought years when high prices prevailed.

The records for 1918–19 did not furnish true hay yields, as the plots were harvested for grain, the sheaves being weighed before threshing.

The Midseason and Early Varieties.

Algerian.—This is still the best all-round variety. A particularly heavy grain yielder, it never attains a great height, but it grows a very thick stand of fine stems and yields a satisfactory quantity of hay. It is liable to lodge.

Guyra is a departmental variety that has shown out as a good all-round oat. It is not as heavy a grain yielder as Algerian, but it usually grows taller and makes good hay.

Sunrise has not yielded satisfactorily, and fluctuates in an erratic manner. It has been known to mature last of all oats, and in any case does not compare with Algerian or Guyra. It is being rejected for this district, and Mulga (Cowra No. 25) will be tried in its place as an early tall-growing variety.

Ruakura has done better than Sunrise, even though its growth is very short. It is not, however, in the front rank as a producer of either grain or hay.

Lachlan is very like Guyra, but inferior.

Yarran (Bathurst No. 5) is also like Guyra, tall growing, but with a tendency to lodge. Lachlan and Yarran are both being rejected.

Glen Innes No. 1 is an almost awnless oat of the Guyra type; it has proved a good grain yielder. Trials are being continued for another season when it will probably be dropped.

Smyrna is very like Algerian, though the grain is larger and the crop matures slightly later. The trials are being continued, but it is not probable that it will displace Algerian.

Cape and *Algerian Tartar* were found defective and poor yielders, and were rejected.

Fulghum is a promising variety from America. *Sixty Day* is an early white or yellow oat, also from U.S.A. Both varieties have only been tried one year.

Mulga (Cowra No. 25) and *Quondong* (Cowra No. 22) are Departmental varieties tried for the first time in 1920.

Kherson is a yellow oat suitable for rack hay, but it is a poor yielder and not satisfactory as a general purpose variety.

Skinless, a poor yielder, was found unsatisfactory and rejected.

The Late Varieties.

White Tartarian is the best of the late varieties, and most suitable for the purposes served by the late oats, as already outlined. It belongs to the side-bearing type, and is known in this district as "Long Sideling." Severe frosts sometimes injure the young growth in winter.

White Ligowo has proved a good hay type in the plots, and is equal to White Tartarian, though not so well known.

Hutchinson's Potato used to be widely grown in the district, but it is now going out of favour.

Danish Island, *Big Four*, *Abundance*, *Storm King*, and *Tartar King* are oats of the same or similar types, mostly imported, which have been rejected as unsuitable.

VENTILATION OF THE HIVE.

THE modern beehive, with its detachable bottom board, allows for the adjustment of the entrance according to the requirements of the colony. It is usually necessary during the summer months, when the colonies are populous, to have an enlarged entrance to the hives, and this allows extra ventilation and easier access for the bees in their heavy work. During the winter, for the comfort of the colony a reduced entrance is desirable, and sufficient ventilation is obtained with the smaller entrance. For a colony of ordinary size a three-eighths-inch entrance, full width, is about right during the winter, while it is often advisable to have a full inch entrance to the hive in the summer.

When extra Ventilation is Desirable.

The bottom boards of the hives are usually manufactured to allow a three-eighths-inch entrance, but when the hot weather comes along and the colony requires extra ventilation, the entrance can be enlarged by inserting wedges between the bottom board and the body along the sides from the hive entrance, as shown in the accompanying illustration.

Various other methods are employed to provide additional ventilation, some preferring to raise the cover of the hive by inserting a wedge under the corner, and others making a second entrance by raising a super at the front. My opinion is that, for the beginner at least, the bottom ventilation of the hive is the best practice. The climate in New South Wales is such that we often get quite cool snaps during summer, especially during the night, and to have a cool draught through the hive is not advisable.—W. A. GOODACRE, Senior Apiary Inspector.

Climate in Relation to Our Wheat.

J. T. PRIDHAM, **Plant Breeder.**

It is not necessary to prove by means of figures that climatic conditions have a greater influence upon a sample of wheat than soil. The flour strength of the f.a.q. sample varies according to the season, and naturally weak flour varieties tend to produce soft grain in whatever soil they may be grown. A climate of moderate rainfall and quick ripening conditions before harvest, however, causes the grain of even a weak flour variety to be harder than grain of the same variety grown under conditions favouring a longer growing period.

In Canada districts are devoted to those classes of wheat particularly suited to their climate, and there are hard spring, soft winter, and durum wheats. In New South Wales such specialisation is not practised, and although our wheats are drawn from districts each of which, by reason of its climate, is particularly adapted to certain classes of grain, we have merely f.a.q. In the Cowra district and in other parts of the west, it has been found that grain of the class of Hard Federation gives as good returns as the soft wheats, but, because its value is not recognised on the f.a.q. basis of marketing, we do not find farmers concentrating on this class of grain. Considering that there is a demand for a superior class of grain overseas, and that the yield per acre of semi-hard varieties in districts such as those just mentioned is not below that of the soft wheats, it is suggested that the climates of the different districts might be exploited to greater advantage. Farmers are not advised to grow strong flour varieties, but rather the medium strong or semi-hard sorts. In this connection reference may again be made to a passage in an issue of *Milling*, quoted by Mr. G. W. Norris in a recent *Gazette*: "It is probable that, if a mixture of these varieties [Bobs, Cedar, Comeback and Florence] was included in greater proportion in the parcel usually exported to this country, the elusive strength element would be present in addition to the excellent colour and yield qualities, which are already inherent characteristics of Australian wheats."

In the Riverina, where there is a greater winter rainfall and a longer growing season than in the western districts, it will probably pay to stick to the soft wheats, but is it making the best use of the precipitation to grow soft wheats in country that will produce beautiful semi-hard grain commanding a higher price in European markets? The soft wheats can be grown to better advantage in the southern districts and in the chief wheat-growing areas of Victoria and South Australia, which receive less monsoonal rain. The present marketing system, of course, does not lend itself to the change advocated, and practical considerations will doubtless suggest various problems; but it cannot be denied that we are not making the best use of our wheat country by growing a heterogeneous collection of varieties and mixing them together. It may be argued that a farmer in, say, the Riverina, can grow as good a sample of Florence as a western farmer; but while it is admitted that there are possibly corners where this can be done, the very best milling grain comes as a rule from the Central Western Slopes, and the two districts are suited to essentially different classes of wheat.

The soundest recommendation is that a farmer should grow what pays him best, irrespective of whether the sample is soft or hard: millers can blend and are able to make use of any description of sound wheat, so that the grower is not in the same position as the orchardist supplying a canning factory, which requires a certain variety of peaches for the trade. If it were possible for, say, the western wheat grower regularly to ship medium hard grain (even though the quality shipped varied according to the season), a demand would arise for this class of grain in the same way as a demand arises for fruit or butter. The fact that the grain would come exclusively from certain districts would facilitate handling at the Australian end, and make possible the most expeditious dispatch of cargoes.

It may be that our wheat crop is too small at present to make the foregoing suggestion of practical significance, at any rate so far as our export trade is concerned. The fact that certain of our districts are better adapted than others for the production of semi-hard grain should, nevertheless, not be lost sight of. A farmer growing a soft midseason or late wheat where an early semi-hard variety would do better usually gets a lower yield, and even if the yield is the same the sample is more or less shrivelled, taking more room in the bags and necessitating extra handling.

THE CARE OF MILKING MACHINES.

THE April issue of the *Agricultural Gazette* contained an article by Mr. O. C. Ballhausen, Dairy Instructor at Lismore, on the care and treatment of milking machines. Mr. W. H. Roberts, a prominent dairy farmer on the Richmond River, has since written expressing appreciation of the information given on the working and care of these machines, and stating that these instructions were very helpful to him. The manager of the North Coast Company's branch factory in that district has remarked on the splendid quality of the cream supplied by Mr. Roberts.

This is an illustration of what can be done when milking machines are properly used.—L. T. McINNES, Dairy Expert.

LEAF HOPPERS ON CITRUS TREES.

REPLYING to an application for advice in connection with the attack by leaf-hoppers of young citrus trees on Kurrajong Soldiers' Settlement, Mr. W. W. Froggatt, Government Entomologist, advocated the spraying of the infested foliage early in the morning with some oil emulsion, such as red oil or kerosene emulsion. By this means the pests could easily be killed.

Farmers' Experiment Plots.

POTATO TRIALS, 1921-22.

Central Coast.

J. M. PITT, Inspector of Agriculture.

VARIETY and fertiliser trials with potatoes were conducted during the season 1921–22, in co-operation with the following farmers:—

J. G. Ward, Sherwood, Macleay River.
F. Kemp, Kempsey, Macleay River.
J. G. Smith, Wauchope.
A Longworth, Ghinni, Manning River.
John Mooney, Dumaresque Island, Manning River.
J. Percy Mooney, Taree, Manning River.
R. Dyball, jun., Taree Estate, Manning River.
A. McSingleton and F. Poole, Mondrook, Manning River.
W. Pemberton, Mt. George, Manning River.
M. O. Pitt, Bulliac, Manning River.
Alex. Smith, Bandon Grove, Dungog.
M. Smith, Paterson.
J. G. Perrett, Miller's Forest, Hunter River.

The season was a moderately good one throughout. So consistent had been the rainfall during the previous summer, autumn, and winter over the whole of the coast that a dry August was a very welcome change. This respite allowed of cultural operations for spring sowings being conducted, although not as thorough as was desired, owing to the drenched nature of the land. During September the Hunter and Manning districts had substantial falls, lighter registrations being the rule at Bandon Grove and along the Macleay. For October moderately heavy rainfalls were registered throughout. During November the Hunter district experienced the heaviest falls, the amounts tapering off to under an inch farther north. In December, however, another general drenching took place, this being accompanied by gales in some instances, resulting in floods of short duration. The weather during this month hardly affected the mature crops, unless to hinder digging operations.

Proper cultural operations, of course, were not possible. A few plots were sown on land lightly covered with flood silt. The yields from these plots were not as heavy as some harvested in previous years, with the exception of that at Paterson, where the soil was of a sandy nature and consequently better drained. Possibly the deposits of silt and the submerging had a "souring" influence on other farms of a colder nature.

The whole of the sowings took place between 11th August and 2nd September. Owing to the moistness of the seed-beds, germination was good, excepting in the case of the Early Rose variety, which failed miserably in one or two instances, thus repeating last year's performance. Being well supplied with eyes, this variety lends itself better than most others to cutting into smaller portions, and the sowing of too small pieces in cold wet ground, rather than faulty seed, was probably the cause of a poor "come up." Except at Taree Estate, where two spray irrigations were applied, a somewhat dry November helped to reduce yields along the Manning. No record yields were harvested anywhere although 11 tons to the acre was exceeded in one instance. The heaviest yields were mostly in the fertilised plots.

The value of an application of fertiliser has so often been emphasised, and the increases are so substantial in proportion to the slight increase in cost involved that it may be regarded as actually wasteful to put in a crop without; especially is this realised if there is borne in mind how essential it is to obtain maximum yields from a crop in which the initial outlay on seed alone is so heavy.

Yet one comes across dozens of instances where the use of fertilisers is not even thought of. The fact of the matter is that the farmer simply will not bother. Very few farmers have appliances suitable for the distribution of the fertiliser, and to perform the operation by hand would be too laborious. Many growers, too, fear that the seed would be burned by being brought into contact with the fertiliser. There is consolation in the thought that there exist growers with wider knowledge and more advanced methods.

RESULTS of Fertiliser Trials.

Fertiliser.	Dunnaresque Island.			Taree Estate.*			Miller's Forest.			Wauchope.		
	t.	c.	q.	t.	c.	q.	t.	c.	q.	t.	c.	q.
No manure	4	6	1	6	17	2	4	0	1	5	17	3
4 cwt. P9	4	4	2	8	16	3	4	19	0	6	7	3
3¼ cwt. M7	4	3	3	6	19	2	4	12	1		....	
2¼ cwt. P7	3	16	0	6	19	2	4	0	2		....	
2½ cwt. superphosphate ...	5	10	3		....		4	6	1	6	2	0
5 cwt. superphosphate ...	4	0	3	7	13	1	4	6	1	6	13	0

*Irrigated.

P9 mixture consists of 10 parts superphosphate, 3 parts chloride of potash, and 3 parts sulphate of ammonia; M7 consists of 10 parts superphosphate and 3 parts chloride of potash; P7 consists of equal parts of superphosphate and bone dust.

Varieties.

Up-to-date, Brownell's Beauty, Factor, and Early Manistee were the most prominent varieties in the trials. The first-mentioned, although it has been a consistently good cropper for many years, is still not so widely grown as Brownell, Satisfaction, or Early Rose. Early Manistee should be a popular variety for early market; when once a reliable source of seed for this variety becomes available in one of the recognised seed producing cooler districts it should take the place of Early Rose, a variety that is gradually running out. Of Brownell's, too, very little pure seed is to be seen. Surely much could be done by co-operation between seed producers in the cooler districts and the growers on our coast.

In spite of a favourable season fungus diseases were notably absent. The ladybird (*Epilachna* 28 *punctata*), was a nuisance everywhere, however, the foliage of many of the crops being quite eaten long before maturity.

Notes on the Plots.

Sherwood.—Alluvial loam; previous crop maize. Ploughed late July, harrowed and rolled, sets ploughed in. Land in good order.

Kempsey.—Stiff loam; previous crop maize. Ploughed late July, and again shortly after; rolled twice, harrowed three times. Land flood covered; sets drilled in.

Wauchope.—Sandy loam; previous crop sweet potatoes. Ploughed July and early August, disced and harrowed and repeated; ploughed again just previous to sowing. Soil fairly moist, weedy. Sets in drills covered with plough and harrowed.

Spray Irrigation of Potatoes at Taree Estate on the Manning.

Ghinni.—Loamy soil; previous crop peas. Ploughed end of July, harrowed, and repeated just before sowing. Flood covered. Rows 2 feet 9 inches apart; drilled in; good order.

Cundle.—Rich alluvial soil; previous crop potatoes. Ploughed end July and again; harrowed and rolled. Sets ploughed in. Land on dry side; good order.

Dumaresque Island.—Sandy alluvial loam; maize three seasons previously. Ploughed end May; fallowed; double-disced harrowed and rolled. Covered by silt. Ploughed and harrowed. Sets ploughed in drills 2 feet 6 inches apart. Land very moist; good order.

Taree Estate.—Rather stiff alluvial soil; previous crop maize. Ploughed three times just before sowing; harrowed three times and rolled twice. Sets ploughed in. Good moist seed-bed.

Mondrook.—Rich loamy soil; flood covered; previous crop maize. Ploughed twice and disced a number of times to get in good tilth. Sown in drills, covered with hoe.

Mt. George.—Stiffish loamy soil; previous crop maize. Ploughed July and again before sowing. Sets sown in drills, covered with plough, rolled and harrowed. Good seed-bed.

Bulliac.—Loamy soil; previous crop maize. Ploughed twice before sowing; harrowed twice. Sets ploughed in. Land in good tilth.

Bandon Grove.—Rich loamy soil; flood covered; previous crop maize. Ploughed three times; harrowed and cultivated. Sets ploughed in. Good seed-bed.

Paterson.—Rich sandy loam; covered by silt; previous crop maize 1920. Fallowed 1921. Ploughed twice, once across, harrowed and cultivated. Sets ploughed in. Good seed-bed.

Miller's Forest.—Stiff loamy soil; previous crop turnips. Ploughed twice before sowing, harrowed occasionally. Sets sown in drills. Good seed-beds.

RAINFALL over growing period (where available) in points.

Month.	Sherwood.	Kempsey.	Ghinni.	Taree.	Bandon Grove.	Miller's Forest.
1921.	points.	points.	points.	points.	points.	points.
August	56	72	46	57	......	......
September... ...	211	265	415	397	211	90*
October	261	319	409	480	233	441
November	135	138	86	165	427	362
December	634	382*	70*	738	169*	453

* Signifies part of month.

For Paterson, Cundle, Bulliac, Wauchope, Mondrook, and Taree Estate no figures are available; for the two centres last mentioned, the figures for Taree may be taken as the closest.

RESULTS of Variety Trials.

Locality.	Sherwood.	Kempsey.	Ghinni.	Cundle.	Taree.	Taree Estate.	Mondrook.	Bulliac.	Bandon Grove.	Paterson.	Miller's Forest.
Date Sown.	18 Aug., 1921.	1 Sept., 1921.	10 Aug., 1921.	12 Aug., 1921.	11 Aug., 1921.	24 Aug., 1921.	2 Sept., 1921.	18 Aug., 1921.	23 Aug., 1921.	12 Aug., 1921.	1 Sept., 1921.
	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.	t. c. q.
Carman	5 7 0	7 15 1	6 8 2	9 13 1	....	....	....	....	....	....	....
Early Manhattan ..	5 14 0	7 13 1	4 18 2	8 17 3	....	4 2 0	6 13 2	....	8 7 1	3 0 3	....
Early Manistee ..	6 15 1	....	6 5 1	7 5 1	....	....	6 2 1	....	....	5 0 0	....
Brownell's Beauty	...	10 0 1	. .	5 7 1	4 6 1	2 4 2	....	5 0 0	....	....	....
Up-to-date ..	...	..	7 7 3	8 3 0	4 11 1	8 5 0	6 19 0	7 2 0	11 10 1	....	7 4 1
Early Rose	3 2 2	Failed	4 10 0	....	....	3 19 0	4 11 1	6 6 0	....	2 0 1	Failed.
Satisfaction ..	...	6 8 1	...	....	....	3 16 2	5 10 0	5 12 0	6 6 2	3 0 1	3 15 2
Factor	4 16 3	....	....	....	....	3 12 2	....	7 18 0	....	4 0 1	....
Scottish Triumph	4 19 1	....	....	....	....	3 0 3	....	....	....	4 0 0	3 8 3

Only a few varieties were sown at Wauchope, and the crops were too poor to weigh.

Spacing Trials.

An experiment was conducted at Mr. W. Pemberton's farm Mt. George with relation to the most effective spacing in drills and rows, and size of tuber. Owing to various reasons (ladybirds did very considerable damage to the growing crops) the results were not satisfactory. Sowings at the wider distance were apparently the most suitable for the season. In each case 1½ oz. sets were used.

	Drills 2 feet 6 inches apart.			Drills 3 feet apart.		
	t.	c.	q.	t.	c.	q.
Sets 10 inches apart in drills	3	14	2	4	10	1
Sets 14 ,, ,, ,,	3	6	3	4	14	1
Sets 18 ,, ,, ,,	2	19	1	4	0	2
Sets 22 ,, ,, ,,	3	12	2	......		

Size of Sets Experiment.

The results in this experiment, which were contrary to those of previous seasons, were as follows:—

Size of Set.	Yield.		
	t.	c.	q.
1½ oz. whole	3	4	3
2 ,, ,, ...	3	10	2
3 ,, ,, ...	2	17	0
3 ,, halved	2	11	3

CAN THE EUROPEAN CORN-BORER BE INTRODUCED IN MILLET?

THE impression seems to have gained currency in certain quarters of late that the European corn-borer has been introduced into this country in Italian millet, and the matter has been made the subject of inquiry by the Department.

The Government Entomologist (Mr. W. W. Froggatt) states that Italian millet has been imported for over thirty years, and no pest has yet been introduced with it. It is cut and dried in Italy, and is treated before it reaches Sydney. On arrival at this port it is carefully examined at the Department's fumigating chambers, the Entomologist himself having conducted several of such examinations without having found any life. After the examination it is thoroughly fumigated before being allowed to leave the premises.

The Commonwealth Quarantine Act further provides that if infection by corn-borer is detected, the whole consignment must be shipped to some place outside the Commonwealth, and, as stated above, even if the examination discloses nothing, the parcel is still fumigated with carbon bisulphide before being released from quarantine.

The Agricultural Bureau Conference at Parkes.

A MESSAGE FROM THE PRESIDENT.

FOLLOWING a very successful conference of western branches of the Agricultural Bureau, held at Parkes on 27th and 28th April, the Conference President, Mr. W. E. Tayler, has addressed a message to all branches in the western district that is likely to interest every producer. The message is in the following terms :—

> While all delegates who attended the recent Conference will agree that it was a great success, and that much good work was done, I would strongly urge members of every branch to begin right now to think about the business for the next Conference—to stimulate interest in the work of their own branches, and to advocate the establishment of new branches in neighbouring districts.
>
> I am firmly convinced that the Agricultural Bureau, when it is established in most of the districts of the State, will be the means of advancing the interests of agriculture in all its branches, and will prove of incalculable value—educationally, economically, and socially—to the people on the land.
>
> There are great possibilities in Rural Credit Societies, which I hope to see started. The system will enable farmers to obtain far more sympathetic financial accommodation than it is possible for the ordinary trading banks to extend to them at present, and will enable farmers to conserve fodder against drought.
>
> The Agricultural Bureau being non-political and free from class distinction, its expressed opinion will be accepted as free from bias, and consequently should carry more weight than that of any other rural organisation.
>
> If every locality in the State were represented by its Bureau branch, as it should be, a district conference would be of immense value, and a State conference an irresistible force.
>
> To make the Bureau work interesting to all members, may I tentatively suggest the following :—
>
> 1. Provide for lectures by Departmental experts on all subjects of interest to members as frequently as possible.
> 2. A sports club in connection with the Bureau.
> 3. Induce members to read papers in your particular branch or branches of agriculture, and freely discuss same.
> 4. Try co-operative buying, and perhaps, selling.
> 5. An annual picnic or sports day, making a feature of the function a pleasant day for the children.
>
> In every way strive to create and foster a community spirit and adopt the slogan "Organise and Co-operate."

A "BETTER BULL" MOVEMENT.

SEVERAL branches of the Agricultural Bureau are exhibiting interest in the possibility of the herds of members being improved by the co-operative ownership of bulls of aristocratic breeding. The Pambula branch purchased a Jersey bull (Cyrus of Abergeldie) at the last Royal Agricultural Society's Show in Sydney, a member having lent the branch the necessary money at 5 per cent. interest. It is hoped that the purchase money will be wiped out in a couple of years with the service charges. More than sufficient cows are already booked for the coming season, members being thoroughly alive to the great benefit the animal may be to their herds. The bull purchased comes of a good milking strain, his dam, Gentiana, having an official record of 586 lb. commercial butter for twelve months.

Field Experiments with Wheat, 1921.

COONAMBLE EXPERIMENT FARM.

J. K. SCHOLER, **Assistant Experimentalist.**

The Experiments Supervision Committee, under whose control these experiments are being conducted, wish to draw the attention of farmers to the fact that final conclusions cannot yet be drawn from the results. The period over which the experiments have been conducted, however, in some cases warrants the drawing of interim conclusions which should be of value.

MANURIAL and variety trials with wheat, the latter for grain and hay, each with two sowings, early and midseason, were carried out on this farm last season.

Owing to there being two distinct types of soil on the farm area—(*a*) the heavy black soil of the open plain country, and (*b*) the red sandy loam of the wilga and pine country—all the trials except the manurial trials, which were sown on the red soil only, were duplicated.

THE BLACK SOIL EXPERIMENTS.

With a view to determining the most suitable sorts to grow on the black soil, and whether on such soil wheat can be grown for grain profitably over a number of years, plots were sown to some nine varieties.

Wheat Variety Trials (Grain).

The varieties tried were Improved Steinwedel, Florence, Clarendon, Firbank, Gresley, Bunyip, Canberra, and Sunset, with Hard Federation for the check plots. The plots measured one-eighth of an acre.

The area on which the plots were situated was under crop the previous year. Hard Federation having been sown for grain, and allowed to remain in the stubble, when it was burned off prior to ploughing. It was springtoothed on 19th March, mouldboard ploughed to a depth of 5 inches on 26th March, and spring-toothed and harrowed prior to sowing.

Early Sowing.—These plots were sown on 21st April and harrowed after sowing; no fertiliser was used, the seed being sown at the rate of 50 lb. per acre on a good but fairly dry seed-bed. The germination was good with the exception of Florence (50 per cent.), but there was not much growth until good rain fell at the latter end of May, after which rapid growth was made owing to the warm, wet winter. These conditions were conducive to the rapid spread of rust with subsequent ill effects. Rain fell during the growing period as follows:—April (1st to 30th), 33 points; May, 292; June 409; July, 357; August, 107; September, 107; October, 72; and November (1st to 10th), 3; making a total of 1,380 points.

The plots were harvested on 10th November under dry conditions. Rust was very bad and only three varieties (Clarendon, Canberra, and Gresley) yielded over 6 bushels per acre.

Variety.	Yield per acre, based on percentage.
	bus. lb.
Clarendon	11 1
Canberra	8 12
Greslev	7 6

Midseason Sowing.—Sown on the same block as early sowing, and treatment prior to planting similar. The plots were sown on 16th May at the rate of 50 lb. per acre, no fertiliser being used. The seed-bed was dry, but rain falling soon after sowing the germination was very good and all varieties made rapid growth from the start.

Rain fell during the growing period as follows:—May (16th to 31st), 285 points; June, 409; July, 357; August, 107; September, 107; October, 72; and November (1st to 14th) 50; total 1,387 points.

The plots were harvested on 14th November. Rain fell on the previous day making the plots tough for stripping.

As in the case of the early sowing, only three varieties yielded up to 6 bushels per acre—Clarendon, Canberra and Florence. Rust was again very bad in the other varieties, Hard Federation being perhaps the one most affected. Clarendon showed very little rust in comparison with the other varieties, and Canberra was fairly clean. In the early sowing, Sunset was badly frosted, flowering as early as 21st July. This variety is unsuitable for early sowing.

Variety.	Yield per acre, based on percentage.
	bus. lb.
Clarendon	13 59
Canberra	9 57
Florence	6 28

Wheat Variety Trial (Hay).

In the trials to determine the most suitable varieties to grow on the black soil for hay, the varieties sown were Florence (check), Warden, Gresley, Firbank, Cleveland, Clarendon, and Improved Steinwedel. The plots measured one-eighth acre. Both early and midseason sowings were sown on the same block as the grain trials, the soil being of a very uniform character. The sowings received similar treatment prior to planting; they were spring-tooth cultivated on 19th March after the stubble had been burned, mouldboard ploughed to a depth of 5 inches on 29th March, and spring-toothed and harrowed prior to sowing.

Early Sowing.—The plots were sown on 21st April on a good but fairly dry seed-bed, at the rate of 50 lb. per acre, no fertiliser being used, and were harrowed after sowing. The germination was good, with the exception of Florence (check) of which none of the plots gave more than a 40 per cent. germination. Very slow growth was made until the latter end of May, when good rain fell and rapid growth was made right through the warm and wet winter. Rust made its appearance as early as the middle of July and spread very rapidly.

During the growing period rain fell as follows:—April (21st to 30th), 33 points; May, 292; June, 409; July, 357; August, 107; September (1st to 28th), 107; total, 1,305 points.

With the exception of Warden and Cleveland, which were harvested on 8th October, the plots were harvested on 28th September, under ideal hay-making conditions, the rainfall during the period of growth being 1,309 points. Owing to the failure of the check variety (Florence) to germinate well, comparative results could not be correctly obtained, but the appended table shows the acre yields. The peculiar conditions at sowing time—the presence, that is, of just sufficient moisture in the seed-bed to germinate a thin bran variety like Florence but not enough to keep it going—was perhaps accountable for the failure of that variety.

Variety.	Acre yield.				Variety.	Acre yield.			
	t.	c.	q.	lb.		t.	c.	q.	lb.
Florence (*check*) ...	0	16	1	20	Cleveland	2	7	1	22
Warden	2	19	0	27	Florence (*check*) ..	0	9	2	19
Gresley	2	17	0	0	Clarendon	2	15	2	14
Florence (*check*) ...	0	14	3	12	Improved Steinwedel	2	14	2	17
Firbank	2	11	3	16	Florence (*check*) ...	1	5	1	17

Midseason Sowing.—The plots were sown on the 16th May at the rate of 50 lb. per acre. No fertiliser was used. The seed-bed was perfectly dry, but rain fell immediately after sowing, and a good germination resulted, followed by vigorous growth. The plots measured one-eighth of an acre. Rust was again very bad as a result of the warm, moist conditions prevailing.

The rainfall during the growing period was as follows:—May (16th to 31st), 285 points; June, 409; July, 357; August, 107; September, 107; October (1st to 8th), 4; total, 1,269 points.

The plots were harvested on 8th October, with the exception of Warden and Cleveland, these two being harvested on 17th October, the rainfall during their period of growth being 1,331 points.

Variety in order of merit.	Yield per acre, based on percentage.				Variety in order of merit.	Yield per acre, based on percentage.			
	t.	c.	q.	lb.		t.	c.	q.	lb.
Warden	2	19	2	11	Cleveland	1	18	0	22
Clarendon	2	17	2	11	Florence	1	16	0	22
Gresley	2	15	3	5	Improved Steinwedel	1	15	3	15
Firbank	2	2	0	0					

Both in the early and midseason sown plots, rust was very bad and undoubtedly lowered the yields. Clarendon was the most resistant variety, and in the hay trials Firbank the least, although all other varieties were more or less badly affected.

Although Clarendon and Gresley have not been grown in this district prior to this season, they give every promise of proving to be valuable additions to the very few varieties suitable for this district.

Owing to the cracking and subsequent drying out of this black soil as soon as the hot weather sets in, and when the grain is filling, the growing of grain is likely to prove a risky undertaking. The dry spring augmented this physical defect of the soil.

THE RED SOIL EXPERIMENTS.

To determine the most suitable varieties to grow for grain, and the correct time to sow these varieties, was made the object of trials on the red soil.

Wheat Variety Trial (Grain).

Two sowings (early and midseason) were made, the varieties tried being Canberra (check variety), Improved Steinwedel, Florence, Hard Federation, Clarendon, Firbank, Gresley, Bunyip and Sunset. The plots measured one-eighth of an acre. Both sowings were made on the same block, and the treatment prior to sowing was similar. The soil was a red sandy loam from which a grain crop of Federation had been harvested the previous season, the land being left in the stubble. The stubble was burned prior to ploughing.

Early Sowing.—Disc-ploughed to a depth of 5 inches 25th March, spring-tooth cultivated and cross spring-toothed the second week in April. Sown on 19th April at the rate of 50 lb per acre, without fertiliser. The seed-bed was moist and fine, but dirty. This was due to the heavy growth of wild melon, etc., which hindered the stubble from burning well. The germination was good and rapid growth was made during the winter, and in contrast to the black soil very little rust was showing; heavy wind and rainstorms on 15th September and 17th and 18th November, caused the plots to lodge and tangle badly. It was found impossible to harvest the plots separately with any degree of accuracy. All varieties, with the exception of Sunset, which was badly frosted, gave promise of excellent yields. The rainfall during the period of growth, 19th April to 18th November, was 1,505 points.

Midseason Sowing.—Sown on 17th May at the rate of 50 lb. per acre, without fertiliser. Harrowed after sowing. The seed-bed was fairly dry and clean and a good germination followed. Rain fell immediately after sowing. The growth was good and no checks were experienced throughout.

Rain fell during the growing period as follows:—May (17th to 31st), 285 points; June, 409; July, 357; August, 107; September, 107; October, 72; November (1st to 16th), 50; total, 1,387 points.

As in the case of the early-sown plots, very little rust was present at harvest time. The plots were harvested on 15th and 16th November.

Variety in order of merit.	Yield per acre, based on percentage.		Variety in order of merit.	Yield per acre, based on percentage.	
	bus.	lb.		bus.	lb.
Clarendon	31	18	Florence .. .	24	24
Canberra	29	48	Firbank	23	53
Hard Federation ...	28	55	Improved Steinwedel	22	52
Gresley	28	25	Sunset	18	21
Bunyip	26	11			

In both the early and midseason sowings, Canberra showed a tendency to lodge more readily than any other variety, and was the only variety to do so in the midseason sowing.

Wheat Variety Trial (Hay).

In this experiment, the aim of which was to determine the varieties most suitable for hay and the most suitable time to sow such varieties, plots of Florence (check variety), Warden, Gresley, Firbank, Cleveland, Clarendon, and Improved Steinwedel were sown. Two sowings were made (April and May) on the same block as the grain variety trials, the land being disc-ploughed to a depth of 5 inches on 26th March, spring-tooth cultivated, and cross spring-toothed the second week in April. The plots measured one-tenth of an acre.

Early Sowing.—The plots were sown on 19th April at the rate of 50 lb. per acre without fertiliser, and harrowed after sowing. The seed-bed was dirty but moist, and a very good germination took place. All plots made fair headway until the end of May, when good rain fell, after which rapid growth was made. Rust was the only disease present, but only to a very slight degree.

The rainfall during the period of growth was as follows:—April (19th to 31st), 33 points; May, 292; June, 409; July, 357; August, 107; September (1st to 16th), 72; total, 1,270 points.

Harvesting took place on 15th and 16th September, with the exception of Warden and Cleveland, which harvested on 6th October, receiving a rainfall of 1,309 points. The results were as follows:—

Variety in order of merit.	Yield per acre, based on percentage				Variety in order of merit.	Yield per acre, based on percentage.			
	t.	c.	q.	lb.		t.	c.	q.	lb.
Warden	3	18	1	25	Clarendon	3	5	1	13
Cleveland	3	15	0	6	Improved Steinwedel	2	13	0	22
Firbank	3	12	0	22	Gresley	2	5	1	18
Florence	3	8	3	15					

Midseason Sowing.—The plots were sown on an area similar to the early sowing, and the treatment received prior to planting was the same. The area of the plot was one-eighth acre.

Sowing took place on 17th May at the rate of 50 lb. per acre without fertiliser, and harrowing immediately after sowing. The seed-bed was dry and clean. Good rain fell soon after planting, bringing about a good germination and a rapid growth. Rust was more prevalent in this trial than on any other sown on the red soil, but not to any great extent.

The rainfall during the period of growth was as follows:—May (17th to 31st), 285 points; June, 409; July, 357; August, 107; September, 107; October (1st to 6th), 4; total, 1,269 points.

The harvesting took place on 6th October, with the exception of Warden and Cleveland, which were left till 17th October, their rainfall being 1,331 points.

Variety in order of merit.	Yield per acre, based on percentage.			
	t.	c.	q.	lb.
Firbank	3	5	0	22
Gresley	3	1	3	6
Clarendon	2	17	1	17
Warden	2	17	1	17
Florence	2	14	2	11
Improved Steinwedel	2	10	2	11
Cleveland . . .	2	6	0	22

Firbank, when grown on the red soil for hay, gives great promise of being a valuable addition to the varieties usually grown in the district. On the black soil it is too liable to rust. The apparent failure of Gresley in the early-sown section is accounted for by the lodging of this plot owing to heavy wind and rain on the night of 15th September. Warden and Cleveland, both being long season varieties, did not do so well in the late as the early sowing, and should be sown in April only.

RIPENING BANANAS IN AN AIR-TIGHT CHAMBER.

THE chambers used for ripening bananas are usually about 6 feet x 6 feet x 6 feet, and are made of best quality T. and G. inch pine They are usually fitted inside with two shelves so that three tiers of bananas can be treated at once, viz., one on the floor, and one on each shelf. A chamber of this size could hold from 100 to 130 bunches, according to size. A slightly larger room would be required to treat 100 cases. The heat is obtained from a gas-ring or jet, or an oil-stove, and the temperature is raised to 75 to 85 degrees Fah. According to the temperature of the fruit when put in and of the outside air, it takes from six to forty-eight hours to ripen, the period being regulated so that the fruit can be removed from the chamber earlier or later as necessary, according to the raising or lowering of the temperature. Experience is needed to avoid the fruit being spoilt during the process.

No heat is used in the summer, the fruit being simply stacked in the air-tight chamber.—R. G. BARTLETT, Assistant Fruit Expert.

The Cultivation of Rye.

J. O. HENRICK, B.A., B.Sc. (Agr.), Instructor in Agriculture,
Hawkesbury Agricultural College.

Rye (*Secale cereale*) is grown to a very limited extent in Australia, and of the area under the crop New South Wales generally contributes about one-third. The area devoted to rye is decreasing gradually each year, owing mainly to the fact that oats are being grown successfully for grain on land formerly considered only suitable for rye. Rye is grown for grain, hay, and green feed, but where wheat and oats grow well it is unwise and wasteful to grow rye.

The following table shows the acreage under rye and the yields obtained in New South Wales during the years 1917 to 1921:—

Year.	Grain.		Hay.		Green feed.	Total acreage.
	Acres.	Bushels.	Acres.	Tons.	Acres	
1917 ..	2,314	30,860	754	759	917	4,012
1918 ..	1,677	19,296	995	1,146	997	3,669
1919	1,425	16,387	997	1,161	1,014	3,436
1920 .	1,207	11,493	1,015	856	1,059	3,281
1921 ...	1,733	31,500	843	1,180	1,166	3,742

The Uses of Rye.

Grain.—In other countries rye grain is principally used in the making of bread and alcoholic beverages. In Australia it is used to a limited extent for feeding live stock; it is usually ground and fed in combination with other grains to horses and pigs.

Green Manure and Forage.—The chief value of rye in New South Wales is—(*a*) for the production of early winter feed on very poor country, and (*b*) as a green manure crop on very poor soils, on account of its hardiness and ability to grow on those soils most in need of assistance. The adaptability of rye to poor sandy soils has been shown by its growth at Hawkesbury Agricultural College, where it has been cultivated as a green manure crop on the sandy parts of the orhcard, and has given better results than anything else. Rye used for pasture and soiling is especially valuable for late winter and early spring feed. Owing to its hardiness it grows during the cold period of the year. Planted early, it may be pastured some time in early winter and again for a few weeks in spring. Its suitability for the production of green fodder has been tested on various farms and on a number of farmers' experiment plots on the coast. Though on average land wheat and oats have given better results, it has also been shown that there is an advantage to be gained by sowing rye on the poor soils. While rye will yield the largest amount of green feed if cut when the ear is just peeping through the sheath, it yields a fair amount of palatable fodder if cut early, and experience shows it is relished by stock when it is young. The value of rye as green feed is greatly enhanced if vetches or field peas are grown with it.

Hay.—Rye makes poor hay for feed purposes, as the straw is too hard and more or less solid. It is used for stuffing horse collars and for bedding.

Soil and Climate.

Rye is adapted to wide climatic ranges, and will do better at high altitudes and in exposed situations than any other cereal. On account of being a fairly deep rooter it is also drought resistant. It responds well to good soils, cultivation, and manuring, but is especially suited to light sandy loams.

It is sometimes called "the grain of poverty," because it can be grown on soils too poor, or where the climate is too severe, to grow the other cereal crops successfully. If the farmer has a very poor patch of pasture from which he desires to obtain an improved quality of feed, and if it is not considered suitable for oats or wheat, it is a good plan to plant it to rye. Good feed will be obtainable from this crop in the early stages of its growth.

Preparation of the Land, Sowing, &c.

The preparation of the land for rye should be as thorough as for other cereals for the best results, but even on badly or roughly prepared land good crops can be obtained. It should be sown in autumn, earlier or later according to when the feed is required. Rye is a quick grower, and matures early. One to two bushels of seed are required per acre. Where conditions are favourable and long coarse straw desired the smaller quantity is used, but under less favourable conditions and where the crop is intended for green feed or green manure the larger quantity is advisable. A good mixture for green feed is one composed of one bushel of rye and half a bushel of field peas per acre. Superphosphate may be drilled in with the seed at the rate of ½ to 1 cwt. per acre.

Harvesting.

For grain the crop should be allowed to become quite ripe in the paddock before harvesting. For hay for the padding of horse collars, the crop is cut while still green, stooked, and when dry stacked. This leaves the straw tough and with a good colour. There is a small local demand for rye straw for collar-making.

Varieties and Disease.

Varieties that can be recommended are:—Black Winter Rye (for early winter feed and grain); Emerald (for late fodder); and White (for collar-making).

Rye is fairly free from diseases and insect pests. The most harmful fungus disease is Ergot (*Claviceps purpurea*). Plants attacked by this disease are affected while in bloom; the ergot increases in size, growing much longer than the grain, and appears as a black, hornlike growth in the ear. The decrease in yield of grain, however, is slight. Ergot, though used medicinally in small quantities, contains a principle that in larger quantities is poisonous to man and animals; it is said to cause abortion in stock. To protect rye from ergot the best plan is to cut before the ears show up.

Some Useful Introduced Fodder Plants.

E. BREAKWELL, B.A., B.Sc.

Tagasaste (*Cytisus proliferus*).

THIS plant is sometimes called Tree Lucerne, but it should not be confused with the true Tree Lucerne, which is *Medicago arborea*. Tagasaste has been grown in New South Wales for a considerable period, but it has never received proper recognition as a fodder plant. One reason for this has been the confusion of the different varieties of this species. Mr. J. H. Maiden, Government Botanist, in the *Agricultural Gazette*, October, 1915, p, 883, pointed out the different varieties, one of which is much superior to the others as a fodder plant.

The distinction is as follows:—

(1) Variety *palmensis*.—Leaves broad (length 2½ to 4 times width). Most leaves pointed. From the island of Palma.

(2) Variety *canareæ*.—Leaves broad, for the most part rounded at the apex. Generally a tall shrub or tree with many-flowered, contracted inflorescences, or with short flower-bearing branches ½ to 3 cm. long. From Grand Canary Island.

(3) Variety *angustifolius*.—Leaves acuminate, narrow, lanceolate; length 5 to 8 times the width. Is confined to Teneriffe.

No. 1 is the true Tagasaste. Nos. 2 and 3 are often called *Escobon*.

The true Tagasaste plant often attains a height of 15 feet in good soils, and all parts of the stems and branches are enveloped in leaves. The leaves are dark green, and when young are almost entirely destitute of the silky hairs so abundant in the species.

Tagasaste is used (*a*) as a hedge plant; (*b*) as a breakwind; and (*c*) as a fodder tree. Hedges of Tagasaste are common throughout the State. As the plant does particularly well in cold districts such as the Blue Mountains, it can be highly recommended for these localities. The leaf growth acquires a considerable density under pruning. Tagasaste is used as a breakwind for orchards in the county of Cumberland, and also, to some extent, on Yanco Irrigation Area. As a fodder tree it has not been grown extensively in this State up to the present. Dr. Percy, of the Canary Islands, has (as mentioned in the article by Mr. Maiden referred to) experimented very successfully with it in this connection. It fattened horses and produced excellent feed for oxen. The analysis of the hay was:—Water, 11 per cent.; ash, 6·5 per cent.; protein, 12·81 per cent.; cellulose, 16 per cent.; extracted matter (non-nitrogenous), 51·89 per cent.; fat, 2·80 per cent. It appeared that the best way of utilising this plant for fodder was to let the tree grow at random for three years, then to cut it back to 3 feet. Animals did not appreciate it at first, but they soon became greedy for it. The plant is also better appreciated if it is pollarded.

Tagasaste (*Cytisus proliferus* var. *palmensis*).

Experiments have been conducted at Wollongbar Experiment Farm to show the value of true Tagasaste as a fodder plant, but the results have been disappointing. The succulent shoots have been fed whole and pollarded to the stock, but the latter would not acquire a taste for it. The same happened at Glen Innes.

The indications are that this plant will find its best use as a fodder shrub in the far west. Trees planted at Nyngan before the drought are now (January, 1922) 12 to 15 feet high, and have developed a very fine leaf growth.

Sainfoin (*Onobrychis sativa*).

This is a leguminous plant which has been cultivated in Europe for hundreds of years. The leaves are long, containing seven to ten pairs of opposite leaflets. The flowers are rosy-red, and are arranged in racemes a few inches long. The fruit is a hard semicircular pod, spiny along the rounded edge and netted on the surface, containing a single seed.

This plant closely resembles Sulla, the main point of difference being in the pod, which in the case of Sulla contains more than one seed. In the *Gardeners' Chronicle* the plant is called *Hedysarum* (Sulla) *onobrychis*. We read there that the old English names given to it were Medic, Vetchling, and Cock's Head. The name Sainfoin came from a French town, whence the first seeds were imported into England. In Germany the plant is called Esparcette, and in Italy Cedrangola. It is recorded in 1697 that the Epsom Downs, which were hitherto barren, grew Sainfoin in abundance. It is particularly vigorous on the calcareous soils of England and Europe, and sends its roots between the rocks on the most barren of places. It is an excellent dairy food, but quickly deteriorates under the action of rain if cut for hay.

Two varieties are cultivated, namely, Common Sainfoin, which is about its best in the third year, and Giant Sainfoin, which is early and rapid in growth, producing two crops of hay in a single year. A heavy seeding (up to 100 lb. per acre) is always recommended.

Owing to the fact that lucerne thrives on the calcareous soils of good depth which are adapted to Sainfoin, the latter can never hope to compete with the king of fodders in New South Wales. In England and Europe lucerne is affected severely by the cold winters, and hence the popularity of Sainfoin. In this State it may have some use on the rocky hills where it is impracticable to grow lucerne.

Sulla (*Hedysarum coronarium*).

This plant is sometimes called French Honeysuckle. It closely resembles Sainfoin, previously described, except for the presence of more than one seed in a pod. It was cultivated in Europe as early as 1596, but is not so well adapted to England as Sainfoin, owing to its greater susceptibility to frosts. There are numerous varieties, mostly differing in vigour of growth, colour of flowers, and in duration of life.

This plant is not grown to any extent in New South Wales, probably for the reasons mentioned in connection with Sainfoin. Reporting trials at Glen Innes Experiment Farm, the Experimentalist, Mr. L. G. Little, stated that it made fair winter growth and good in spring and early summer. It has less leaves and more stems than other clovers except Bokhara. The stems are thick and sappy, and later become pithy, attaining a length of up to 3 feet. It flowered profusely throughout November in the trials just referred to, but set no seed.

Teosinte (*Euchlaena luxurians*).

By many botanists this plant is supposed to be one of the original ancestors of our present-day maize (*Zea mays*).. A closely-allied species is *E. mexicana.* It differs from a typical maize plant (1) in its numerous branching habit, sometimes as many as forty or fifty coming from a single seed, and (2) in the tassels having both male and female flowers.

Teosinte grows luxuriantly in the fertile soils of Mexico and Central America. Professor Piper, the American agrostologist, points out that its cultivation in America has dwindled, as it does not yield as well as the sorghums on moderate soils, nor as well as Japanese sugarcane on rich soils. It cannot, of course, compete with maize as a grain-producing crop. Baron von Mueller points out that it is rather slower in growth than maize, and not as hardy as sorghum. In a trial at Berry Experiment Farm in 1904 a single plant grew to 10 feet and weighed 100 lb. The leaves grew to a length of 3 feet. It was saccharine in its young state, but not so when it became old. It was rather slower in growth than maize, but lasted much longer in a succulent state. One pound of seed will grow over an acre of land.

Lespedeza or Japanese Clover (*Lespedeza striata*).

This is another plant native to Japan and Eastern Asia which is credited with being a very hardy and nutritious annual. It does not grow very tall except on good soils. It has small leaves, and branched, rather woody, stems.

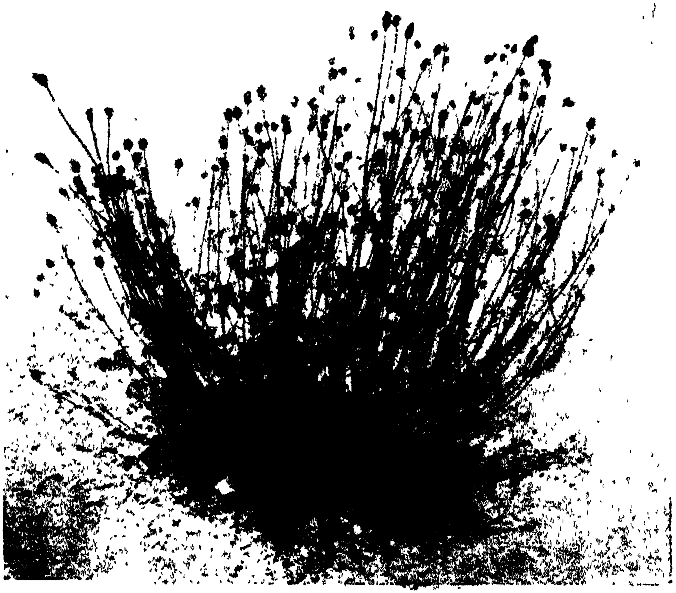
In the United States (particularly in the south) it is now grown extensively, developing sufficiently in some localities to be cut for hay. It has been found that the application of phosphatic fertilisers means all the difference between a poor and a heavy crop. Great success has been obtained with it by growing with Bermuda grass (our ordinary couch) on the heavier soils, and with carpet grass (*Paspalum compressum*) on the sandy soils. It is affected badly by frosts, and is purely a warm-weather clover. Its palatability and nutritive qualities are of a very high order, and owing to the limited amount of moisture it does not cause bloating to the same extent as other clovers. It is also recommended in the United States as a rotation crop, using a three-year rotation of maize, oats, and Lespedeza. The corn is harvested the first year, oats and Lespedeza the second year, and Lespedeza alone the third year. This would, of course, necessitate a late planting of oats as far as this State is concerned.

This clover has not become popular to any extent in New South Wales. Factors affecting its progress are (1) the infertility of the seed that is sown, and (2) its very slow growth in the early stages, particularly if the weather conditions remain cool. Lespedeza seed deteriorates very quickly with age, and one-year-old seed has a very low capacity for germination, while that which is two years old is practically useless.

It is quite probable that if fresh seed were sown in the warm months the clover would produce good results on many parts of our coast, and if it can be made to grow in combination with couch grass (as in America) it will serve a very useful purpose.

Kudzu (*Pueraria Thunbergiana*).

This is a vigorous leguminous vine native to Japan. It has been in use for many years as an ornamental trellis vine, but was only recently used as a fodder in the southern states of America. The reputation obtained from its fodder yields there has induced other agriculturists to take it up, and a keen demand for it has been set up in this State.



Sheep's Burnett at Bathurst Experiment Farm.

The vine grows luxuriantly in the warm months of the year, sending over the surface of the ground long trailers, which readily root at every node. The leaves, which resemble those of the common bean, are hairy, and so are the stems. Under our coastal conditions the plant attains a height of about 2 feet. The plant does not set seed with us, and propagation from roots or cuttings is necessary. These should be firmly established before transplanting. It has also been found that the roots dry out very quickly, and should be planted as soon as possible after lifting.

The yielding and nutritive qualities of Kudzu are very satisfactory in hot humid climates. It is doubtful, however, if it will displace the Velvet or the Rice bean on the Northern Rivers. Its perennial character is also against it as a rotation crop, and cowpeas will always probably be preferred in this respect. An advantage attached to this plant is that it will thrive on poor sandy soils, such as those around Sydney and in the county of Cumberland. A single root planted in spring will easily cover a circle of ground of 4 to 5 feet radius by the end of the season. The plant completely sheds its leaves during the winter months, but the runners, although seemingly dead, retain their vitality remarkably well, and send out shoots in all directions on the first approach of spring.

It is quite possible that Kudzu cultivation will be taken up for the poorer class of soil in our coastal districts; but its best use appears to be for hay rather than for pasture.

Sheep's Burnet (*Poterium sanguisorba*).

This is a plant belonging to the rose family. It is a perennial, growing up to 2 feet high. There are fifteen to twenty small, deeply-toothed leaflets to each leaf. The heads are small and globular, and green. The seeds are large, angular, and rough. Under natural conditions in Europe and Asia this plant thrives in very dry situations, and this explains why the plant is adapted to the poorer and drier soils of this State. In Europe it receives the common names of Burnet Poterium, Salad Burnet, and Garden Burnet.

Sheep's Burnet is well adapted to the poorer and shallow soils of our tablelands and slopes, and is extensively used by farmers in pasture mixtures. It is a plant that will stand heavy stocking, and endures dry conditions remarkably well. It will not, however, endure the extreme summer conditions of the far west.

An extensive trial was given this plant some years ago at Bathurst Experiment Farm, where it was planted in drills 18 inches apart. Notwithstanding the drought it grew well, and was fed off by sheep several times during the season (spring and summer). It was harvested for seed during the second year's growth and produced seed at the rate of 263 lb. per acre. It remained green both winter and summer. While young it provided a good fodder plant, particularly for sheep, but when allowed to grow old it became somewhat woody and was not relished. Subsequently this plant was included in a mixture of Cocksfoot and Fescue for the hard, gravelly soils of the hills, and it persisted for years under heavy stocking.

At Hawkesbury Agricultural College this plant established a reputation during the drought period about 1905. It also does remarkably well at Glen Innes Experiment Farm, where it makes a very early spring growth, and is out in flower by October. It yielded heavily for two cuts for the season; 50 lb. of green fodder dried to 12½ lb of hay.

Sheep's Burnet should be sown in autumn. If sown alone 15 lb. of seed per acre should be used; when mixed with other grasses 4 to 6 lb. will suffice.

A Few Hints on Poisoning Rabbits.

CHAS. J. WOOLLETT, Stock Inspector, Tamworth.

THE methods of preparing poisons for rabbits are numerous, but the following methods have been proved to be successful. Modifications of the methods mentioned are also successful.

Phosphorized Pollard.

The use of poisoned pollard, distributed by means of a cart, is becoming very general in this district. Most of the large landholders have used the poison cart for many years, but now farmers are combining and purchasing carts in small groups. The Tamworth Pastures Protection Board has eight carts going in different parts of the district, and their success has induced many farmers and graziers to purchase carts for themselves, and to use them as often as found necessary, because the Board's carts do not get round as often as is sometimes desired.

Rabbits will not always take poisoned baits for some unknown reason, but it often happens that whilst "bunny" refuses to be killed by phosphorus, he will readily take poisoned thistle root. When rabbits are not taking a poison well it is advisable to change the bait.

There is no doubt that at times stock are poisoned by baits put out for rabbits, but for the amount of poison laid the casualties to stock are comparatively rare. When stock do take the baits, it is generally those that have been hand-fed at some time. Thoughtlessness on the part of the person who drives the cart is sometimes responsible for loss, as when a trail is drawn through a sheep camp. Sheep will sometimes pick up a bait on the camp, and then follow the trail. It is not advisable to mix salt with the pollard when the trails are to be laid in paddocks where sheep are running. It is often done without any loss, but it is risky, and sooner or later losses will occur. Without salt in the bait the risk of poisoning sheep is very small.

An important point in the use of the poison cart, according to a man who was continuously using a cart for the Tamworth Pastures Protection Board for six years, is to wash all the pollard out of the machine every evening. To do this the screw at the bottom of the drum must be removed. This man was a very successful poisoner, and killed rabbits with phosphorus when other men failed. He states that the pollard left in the cart quickly sours and taints the baits that work through the machine. Rabbits will not touch sour baits.

It is important that the baits should not be too soft. How to gauge the correct consistency will come with experience. If too much water is used the baits are not cut properly, and they stick to each other, with the result that long rolls are put out. In such cases there is danger to stock, as well as waste. The proper quantity of water depends on the quality of the pollard.

If the operator is treating fairly level ground and has a strong horse, he should be able to put out two tins of poison in a day of eight hours.

The following preparation has been found very useful:—

Two tins poison (such as S.A.P., Bosker, I.X.L., Little Doctor, and other brands);
14 lb. of pollard;
2 lb. of bran;
2 lb. brown sugar or treacle;
1 dessertspoonful of ground cinnamon;
6 to 7 quarts of water.

The ingredients are best mixed in a tub. The poison should be dissolved in about 4 quarts of warm water and thoroughly stirred. The sugar should be dissolved in water before being added, and all the ingredients should be mixed to a thick doughy consistency. If the rabbits have not been interfered with for some time they will generally take the bait without sugar or cinnamon. When they become a little "poison shy," then add one or both of those ingredients.

The best time to use the poison cart is after a dry spell, when rain falls in sufficient quantity to soften the ground, when feed is beginning to grow, and when the feed is ripening. If practicable the best time of the day to set out phosphorised pollard is late in the afternoon, as the sun makes the bait hard and less attractive.

It must be remembered that rabbits take two to three days to die from the effects of phosphorus, unless they have eaten many baits, when they will be found near the trail.

Black Thistle Root and Strychnine.

This is the method used when rabbits are worth skinning. The beginner is often unsuccessful when using strychnine, and then rabbits are said not to be "biting." The principal mistakes made are in using too much strychnine, and not powdering it sufficiently. When too much strychnine is used the bait is too bitter for "bunny's" taste. To obtain satisfactory results it is imperative that the poison should be very finely powdered. This is best done by using pestle and mortar, which cost about 2s. 6d. at a chemist's shop.

Care should be taken to use only clean vessels in preparing baits, as the smell of petrol or kerosene is objected to by rabbits.

The best thistle roots are obtained from plants whose leaves are spreading on the ground. When the stalks grow above the ground the roots become too tough and fibrous for obtaining the best results.

When this bait was first used care was taken to scrape the skin off the root, but many successful poisoners do not bother to do this, and get very good catches if the roots are only well washed. After washing they are cut into pieces about half an inch long, and if the roots are thick they are halved and quartered. They should then be placed in a vessel, and, according to the quantity of roots, sugar should be sprinkled over them, stirred occasionally, and left for about two hours. The syrup should then be poured off, and the roots spread out on a clean bag, and allowed to dry in the shade, not in the sun. Then to 2 lb. of thistle root add as much finely-powdered strychnine as will fill the top of a cardboard matchbox, taking care, of course, to distribute the poison by well stirring the roots while sprinkling the poison over the roots in the billycan or jam tin.

Sometimes the baits are laid by means of a poison cart with a funnel attachment, into which the baits are dropped and directed into the furrow made by the share. Other methods are used to make the trails.

In some cases the tine of a cultivator is fixed into a heavy forked stick, which makes a good trail. When hand-poisoning, a hoe is often used to lift a sod, the baits being placed on the top of the sod or in the hole. However, there is no need to make a hole or trail to attract rabbits if they are at all numerous.

When hand-poisoning, the best places to scatter the baits are on the feeding grounds where grass is short, on the buck or pill heaps, under logs where rabbits camp, directly over burrows, along the tops of spurs of hills, and in hilly country, especially round sheep camps. The best time of the day to lay thistle root baits is just before dark.

Another successful method is to poison the taproot in the ground. To do this dig round the thistle to a depth of about 2 inches, then cut the leaves off the top just below the level of the ground, split the root downwards to a depth of ¾ inch to 1 inch, and put finely-powdered strychnine in the split, using as much as can be put on the tip of a pocket-knife blade. Rabbits eat down one side of the split and then the other, and it is common to see seven or eight rabbits dead in a heap round the thistle. Rabbits will even be found dying from eating it a month afterwards.

Wheat and Strychnine.

To three-quarters of a 7-lb. treacle tin full of wheat add hot water. This will cause the wheat to swell and fill the tin; add a matchbox-lid full of finely-powdered strychnine, and then lay out in a trail. This bait must not be put out in a paddock where any class of stock are running.

Poisoned Sticks.

Rabbits take to eating the bark of trees at times. By preparing green sticks from such trees good hauls are often made.

One very successful poisoner in this district uses the sticks of a shrubby prickly bush—it has no vernacular name that I know of—that grows on the hills in this district. He gets the green branches and cuts them into pieces about an inch long. A thin paste of flour and sugar is made and is covered over the stick by stirring. When the paste is well distributed and nearly dry, an ounce of strychnine is added to a kerosene tin full of sticks, which are then used like thistle root. On several occasions I have seen excellent catches made by this method, and in one instance when an alleged decoy was being given a trial, the user of the sticks got the best results over all other methods.

(*To be continued.*)

TO MAKE ESSENCE OF LEMON.

REPLYING to a question on the point, a recent correspondent was informed that it is not possible to make a moderately concentrated essence of lemon without the use of a high percentage of alcohol.

Oil of lemon does not mix with water, but it dissolves in alcohol, and the stronger the alcohol (that is, the less water it contains) the more oil of lemon it dissolves. Absolute alcohol mixes freely with oil of lemon; but, according to Squire's "Companion to the British Pharmacopœia," alcohol at 90 per cent. dissolves about 8 per cent. of oil of lemon, and if the alcohol is less than 90 per cent., it dissolves less than 8 per cent., according to the alcoholic strength. Milkiness can only be remedied by adding more alcohol.

In one formula, glycerine is recommended, which would take the place of the alcohol, but it is doubtful whether the cost is not higher. The formula is as follows:

	oz.
Oil of lemon	1¾
Rectified spirit of wine	6
Pure glycerine	3
Pure calcium phosphate	4 (2 oz. ought to be enough).
Distilled water to make a pint.	

Mix oil of lemon, spirit of wine, glycerine, and 8 oz. of distilled water; agitate briskly in a quart bottle for 10 minutes; introduce the calcium phosphate, and shake again. Put in a filter and let it pass through twice; add 1½ oz. of fresh lemon-peel, digest in filtrate for two or three days, and again filter.—F. B. GUTHRIE.

AUSTRALASIAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE.

THE Wellington meeting of this Association will be held in January next, which will be the third time that the Australasian Association for the Advancement of Science has met in New Zealand, previous meetings having been held in Dunedin and Christchurch.

It is desired to make the Agricultural and Veterinary sections outstanding features of the meeting, and owing to the comparatively large number of professional agricultural officers employed by the Government and various institutions in New Zealand compared with other States of the Empire, it is anticipated that the programmes of these sections will be filled to the utmost limit.

The session of the Association is fixed to begin on 9th January, 1923, but authors of papers which they desire to read or have read at the meeting should send in the titles as soon as possible to Mr. B. C. Aston, Department of Agriculture, Wellington, in order that suitable arrangements may be made to ensure proper treatment for each contribution. It is only desired that the titles of papers should be sent in at first, but the whole of each paper, with an abstract prepared by the author, should be in the hands of the Section Hon. Secretary not later than 27th December, 1922.

Sweet Potatoes.

EXPERIMENTS WITH VARIETIES FROM THE UNITED STATES.

W. D. KERLE, Inspector of Agriculture.

SEVERAL varieties of sweet potatoes from the United States were sown at Grafton Experiment Farm in the season 1920-21, and with the seed made available plantings were carried out last season on experiment plots owned by two farmers in the Upper North Coast district—Mr. F. L. Playford, Glenreagh, Orara River, and Mr. E. A. Amps, Camira Creek, Grafton.

At Glenreagh the planting was made on a reddish loam of clayey nature and medium fertility. Plants were set out on 30th November, 1921, the plants being 2 feet 6 inches apart, in rows 3 feet apart, the drills being made with the plough and covered by throwing a couple of furrows to the plants. As moisture was rather scarce the roller was run over the whole plot, followed by a light use of the cultivator between the drills. Despite dry and hot weather for a fortnight, only very few plants missed. In December 694 points of rain fell, two weeks after planting. Only 225 points fell in January, but in February 2,252 points were registered, causing the Orara to overflow its banks; as a result half the experiment plot was covered, but the water did not remain long enough to do any damage. In March 198 points were recorded, and up to 19th April, when the crop was harvested, 155 points. The yields were as follows:—

Variety.	Yield per acre.			
	t.	c.	q.	lb.
Porto Rico . . .	15	3	0	5
Triumph .. .	12	10	3	27
Yellow Strassburg	12	9	3	4

At Camira Creek the planting was done in a similar manner. The soil here is a poor grey sand, and superphosphate was applied at sowing time at the rate of 2 cwt. per acre. Sowing was made on 12th December, and was followed immediately by heavy rains (860 points to 31st). January was comparatively dry with 128 points, and February correspondingly wet with 1,231 points. During March, April, and up to harvesting on 12th May, less than 50 points were recorded, and the yields obtained were poor in consequence. They were as follows:—

Variety.	Yield per acre.				Variety.	Yield per acre.			
	t.	c.	q.	lb.		t	c.	q.	lb.
Pink	6	6	0	0	Porto Rico	4	16	3	20
Yellow Strassburg ...	5	14	2	10	Southern Queen ...	3	12	1	14
White Maltese	5	5	0	4	Red Bermuda ..	1	5	3	16

Triumph is a white variety, uniform in size, with a vigorous habit of vine growth. It is an excellent table variety, and the best for marketing.

Yellow Strassburg is of large size and round in shape, and the growth of the vine very robust. Good table variety, and keeps well. Some exceptionally large tubers of this variety figured in the Camira Creek plots, despite the unfavourable season.

Porto Rico bears spherical tubers of a golden colour; vine growth vigorous, good keeper, best table variety.

Southern Queen is a cream-coloured long type, with a robust habit of growth. A good culinary variety, and keeps particularly well.

Red Bermuda has a deep red colour and long trailing vines. It is apparently a poor yielder under adverse conditions. It is a fair cooking variety.

The imported varieties have done so well under adverse conditions that, when they become acclimatised and experience a normal season, high yields should be obtained. They are for the most part superior to existing varieties in flavour and cooking qualities generally, and for this reason, if for no other, are valuable additions to our list of sweet potato varieties.

"WHEAT PRODUCTION IN NEW ZEALAND."

UNDER the above title, Mr. D. B. Copland (M.A. of the New Zealand University, now Lecturer in History and Economics in the University of Tasmania) has provided in a book of 300 pages a comprehensive consideration of the wheat industry in New Zealand. The tendency towards pastoral farming in the Dominion is said to be causing such an efflux of labour and capital from purely agricultural pursuits that these are becoming endangered. Indeed, a persistent decline in wheat production during the past ten years has occasioned much apprehension. It has been said that New Zealand is "a remote farm," and in a day when there is no small disposition to increase the number of those competent to deal with the physical and biological aspects of agriculture, an effort to touch the industrial and economic problems that confront the industry under such conditions is of more than local significance.

As a result of his discussion of the subject, Mr. Copland reaches the conclusion that "we have reached a trough in the graph," and anticipates a general upward movement for some years, though the serious reaction against wheat growing in the past few years may prove embarrassing for a considerable time.

In a clear and readable fashion, Mr. Copland deals with the conditions that obtain in New Zealand, the quality and variety of wheat, the price, cost of production, land, labour, capital, organisation, &c., and Dr. F. W. Hilgendorf, of Canterbury Agricultural College, contributes a useful chapter on the improvement of wheat by selection in New Zealand. Numerous tables and seventeen graphs contribute to the clarity of a valuable treatise on a subject whose interest is by no means limited to its own country.

Published by Whitcombe and Tombs, Limited. Our copy from their Melbourne house.

Notes on Wheats entered for the Royal Agricultural Society's Show.

EASTER, 1922.

F. B. GUTHRIE AND G. W. NORRIS.

IT is very satisfactory to record that in this, the Centenary Show of the Royal Agricultural Society, the number of entries constituted a record. The entries totalled 102, of which seven were collections of five varieties each, making a total of 130 individual exhibits. The prize-money (£136) was divided among seven exhibitors, of whom the most successful were Messrs. Smith Pollock (Quirindi), and D. and T. Gagie (West Wyalong), both of whom secured three first prizes and one second.

The establishment of a special class for Florence and its removal from the medium strong-flour class - in which it invariably took the first, and generally the second prize—has had the desired effect of opening the medium class for competition, and the first and second prizes were taken by varieties not previously among the prize-winners, namely, Quality and Sicilian Wonder. Quality is a remarkably fine sample. It has the highest bushel-weight of any sample exhibited (68 lb. per bushel), and is stated to have yielded 27 bushels to the acre. It is an importation from America, and is one of Luther Burbank's creations. There were fifteen entries in the special class for Florence wheat. The introduction of a novice class for Federation was also successful, as it produced five entries, and the winner gained a second prize in the open weak-flour class.

Speaking generally the classes were well filled, the exhibits well up to the previous highest standards, and the competition close and keen. Owing to the late date on which Easter fell a somewhat longer time was allowed for the examination of the samples, and it was possible to subject a larger number than usual to the milling test. It would be more satisfactory to the exhibitors if a still greater proportion could be milled, but under existing conditions only one wheat can be milled at a time, and as it takes at least a day to mill and test a sample, the period between the date of the arrival of the samples and the date of judging is insufficient to allow of more being milled. The Royal Agricultural Society has ordered a second mill, which should arrive in a few months' time, and be in working order before the next Show, when it will be possible to examine a much larger proportion in respect to their milling qualities.

The judges were Messrs. R. W. Harris (Gillespie Bros.), and G. W. Norris (Department of Agriculture), the milling of the samples being carried out by Mr. Norris. The judging was carried out as in previous years. The bushel-weights of all samples were first taken: the results are given in the second of the accompanying tables. After careful inspection to eliminate inferior exhibits, those which were considered eligible for prizes were milled in the model mill of the Department of Agriculture, and the prizes finally awarded in accordance with their actual behaviour in the mill, points being assigned for the different milling characteristics. The results of these tests are given in the table headed "Results of Milling Tests."

The following notes were supplied by the judges:—

The wheats are quite up to the samples of previous years. Of course there are a few exceptions, as would be expected with a large entry, especially with the softer types of wheat, which are the first to be affected by adverse weather conditions. Other defects such as weevil and smut, while only of a minor degree, were sufficiently marked to eliminate quite a large number of samples in the different classes after the preliminary inspection.

Several varieties new to the Royal Show, such as Sicilian Wonder, Wilfred, and Quality, are very attractive looking samples. The Macaroni class has only two entries, both satisfactory samples and easy to place, first prize going to Huguenot and second prize to Medeah, both grown by Mr. S. Pollock, Quirindi.

The Strong Flour Red class is well represented with excellent quality wheats, and even with the aid of milling tests they were most difficult to separate, there being only a few points difference in the four leading samples. The first prize sample, Cedar, grown at Quirindi by Mr. S. Pollock, gained 94 out of 100 points. The bushel weight (66¾ lb.) yielded 73·8 per cent. of flour, contained 13·1 per cent. of dry gluten, and had a water absorption of 55·6 quarts per 200-lb. sack of flour. The second prize also went to a sample of Cedar, grown by Messrs. D. & J. Gagie, West Wyalong, which secured a total of 93 points, being only one point behind the first prize sample The bushel weight (66 lb.) yielded 73 per cent. of flour, contained 11·9 per cent. of dry gluten, and a water absorption of 55 quarts per 200-lb. sack. Both these exhibits are of excellent quality, and it is worthy of note that this variety still retains its high milling excellence, and in this respect is the premier red wheat of Australia.

The Strong Flour White class contains some very attractive samples of Comeback. The first prize sample- Comeback, grown at West Wyalong by Messrs. D. & J. Gagie secured 92 points. It weighed over 66 lb. per bushel, and when milled, yielded 74·8 per cent. of flour. The flour is of excellent colour, a high water absorption (over 55 quarts per sack), and contained 11·3 per cent. dry gluten. The second prize sample (also Comeback, grown at Woomelang, Victoria, by Mr. A. R. Michael) secured 91 points. When milled it yielded a flour of excellent colour, rich in gluten (over 14 per cent.) and with a water absorption of 54 quarts

The Medium Strong class attracted a large entry, and consisted of many varieties of wheat The first prize went to a sample of Quality, grown at Gilgandra by Mr. W. H. Scholz, securing 83 points. It is the heaviest wheat in the whole exhibit, weighing 68 lb. per bushel, and an excellent milling wheat, yielding over 73 per cent. of flour. The flour is rich in gluten, of good colour, and has a high water absorption (50 quarts per sack). The second prize, a sample of Sicilian Wonder, grown at Pallamallawa by Mr. J. T. Maunder, secured 82 points. This is also an excellent milling wheat, yielding 73 per cent. of flour which is of good colour, contains 11·6 per cent. of dry gluten, and has a water absorption of 48 quarts per sack. Mr. Maunder was the winner of this year's field competition. Similar to other classes, the aggregate number of points awarded to the different entries was very close. For example, three varieties (Canberra, Bunyip, and Gresley) each scored 81 points.

Wilfred, grown at West Wyalong, and exhibited by Messrs. D. and J. Gagie, although a wheat of fine appearance and good milling qualities, was beaten by such fine samples as Quality and Sicilian Wonder. The class Florence Special attracted a great number of entries. After the preliminary inspection and weighing, two samples exhibited by Messrs. D. and J. Gagie, of West Wyalong, and Mr. W. H. Scholz, of Gilgandra, which were superior on appearance and weight per bushel, were milled, and as they both scored an aggregate of 86·5 points, it was necessary to divide the prize money between the two competitors.

The Federation Special (novice) class was disappointing, the entry being small and the quality poor. A sample exhibited by Mr. J. W. Eade, Euchareena, was awarded the prize, although not quite up to the standard of a prize sample The Federation Special (open), like the novice class, was also disappointing, on account of the small entry and the poor quality of the samples. The prize was awarded to the estate of the late Mr. T. Bragg, Mungeribar.

The weak flour class attracted a large entry, covering a wide range of varieties. The first prize went to a sample of Petatz Surprise, grown by Mr. S. Pollock, of Quirindi, which yielded 74·6 per cent. of flour. The colour of this is excellent, it is rich in gluten, and has a satisfactory water absorption. The second prize went to Currawa, grown by Mr. J. W. Eade, at Euchareena. This is a fine sample and weighed 67¼ lb. per bushel. It is a good milling wheat, yielding over 73 per cent. of flour, but it is weak compared with the first prize sample.

The following tables give the result of the examination of the competing samples, namely weights per bushel, milling tests, and awards made:—

WEIGHTS PER BUSHEL.

Catalogue No.	Variety.	Bushel-weight.	Catalogue No.	Variety.	Bushel-weight
		lb.			lb.
		Class 1101 (Macaroni).			
7058	Huguenot	66	7059	Medeah	66
		Class 1102 (Strong Red).			
7060	Cedar	66¼	7064	Cedar	66
7061	,,	66¼	7065	,,	66½
7062	,,	66¼	7066	Marquis	65
7063	,,	66	7067	Cedar	66¼
		Class 1103 (Strong White).			
7068	Comeback	65¼	7072	Comeback	65
7069	Pusa 104	65¼	7073	,,	66¼
7070	Comeback	66¼	7074	,,	66¼
7071	,,	65¾			
		Class 1104 (Medium Strong).			
7075	Clarendon	66¾	7088	Canberra	64¼
7076	Firbank	65	7089	Sicilian Wonder	67¼
7077	Bunyip	65¼	7090	Clarendon	64¼
7078	Firbank	65½	7091	Bald Early	62¾
7079	Canberra	67¼	7092	Yandilla King	63½
7080	Gresley	66¼	7093	Canberra	66½
7081	Wilfred	66	7094	Bomen	63½
7082	Canberra	67¼	7095	Canberra	66¾
7083	Gresley	65¼	7096	Cleveland	63½
7084	Bunyip	64½	7097	Canberra	65½
7085	Canberra	66¼	7098	Pusa 107	66¾
7086	Yandilla King	64	7099	Quality	68
7087	Bomen	65½	7100	Canberra	65¾

WEIGHTS PER BUSHEL—*continued.*

Class 1105 (Florence Special)

Catalogue No.	Variety.	Bushel-weight. lb.	Catalogue No.	Variety.	Bushel weight lb.
7101	Florence	66¼	7109	Florence	64¾
7102	,,	65½	7110	,,	64¾
7103	,,	65¾	7111	,,	64½
7104	,,	65½	7112	,,	64¾
7105	,,	64¾	7113	,,	65½
7106	,,	66¼	7114	,,	66½
7107	,,	64½	7115	,,	67½
7108	,,	65			

Class 1106 (Federation Special [Novice]).

Catalogue No.	Variety.	Bushel-weight. lb.	Catalogue No.	Variety.	Bushel weight lb.
7116	Federation	63	7119	Federation	64¾
7117	,,	59½	7120	,,	63¾
7118	,,	61			

Class 1107 (Federation Special)

Catalogue No.	Variety.	Bushel-weight. lb.	Catalogue No.	Variety.	Bushel weight lb.
7121	Federation	64	7123	Federation	65
7122	,,	-	7124	,,	63¾

Class 1108 (Hard Federation Special).

Catalogue No.	Variety.	Bushel-weight. lb.	Catalogue No.	Variety.	Bushel weight lb.
7125	Hard Federation	65¼	7130	Hard Federation	65¼
7126	,,	65	7131	,,	64
7127	,,	65¾	7132	,,	66¼
7128	,,	64½	7133	,,	64¼
7129	,,	63¾	7134	,,	66

Class 1109 (Weak Flour).

Catalogue No.	Variety.	Bushel-weight. lb.	Catalogue No.	Variety.	Bushel weight lb.
7135	Steinwedel	67	7144	Currawa	66½
7136	Federation	63¾	7145	Warden	64½
7137	Petatz Surprise	67	7146	Queen Fan	64¼
7138	Baroota Wonder	--	7147	Currawa	63¼
7139	Warden	63¼	7148	Purple Straw	66
7140	Currawa	67¼	7149	,,	63¾
7141	,,	64	7150	Currawa	62¼
7142	,,	66¼	7151	Federation	61¼
7143	Purple Straw	66½	7152	Petatz Surprise	65¾

Class 1110 (Collection (5) Farrer Wheats).

Catalogue No.	Variety.	Bushel-weight. lb.	Catalogue No.	Variety.	Bushel weight lb.
7153	A Bomen	65	7155	A Canberra	65¾
	B Canberra	67¼		B Cedar	66½
	C Clarendon	66¾		C Comeback	66
	D Florence	66½		D Florence	67¼
	E Rymer	66¼		E Hard Federation	66½

Catalogue No.	Variety.	Bushel-weight. lb.
7156	A Bobs	66¼
	B Cedar	66
	C Comeback	66
	D Federation	65¾
	E Jonathan	64½

Class 1111 (Collection (5) Non-Farrer Wheats).

Catalogue No.	Variety.	Bushel-weight. lb.	Catalogue No.	Variety.	Bushel weight lb.
7157	A Billy Hughes	65¾	7158	A Huguenot	65½
	B Currawa	66½		B Medeah	65½
	C Purple Straw	66		C Petatz Surprise	66¾
	D Steinwedel	67		D Pusa 104	65½
	E Yandilla King	66		E Pusa 107	65½

RESULTS OF MILLING TESTS.

	Appearance of Grain.	Weight per bushel.		Ease of Milling.	Percentage of Flour.		Colour	Percentage of Gluten.		Strength.		Total Points.
	—	Points Awarded.	Actual Weight.	—	Points Awarded.	Actual per cent.	—	Points Awarded.	Actual per cent	Points Awarded.	Water Absorption	—
Maximum Points	10	15		10	10		15	20		20		100
Catalogue No.												
Class 1102 (Strong Flour, Red).												
7067	10	13	66¼	9	10	73·8	15	17	13·1	20	55·6	94
7061	10	13	66	9	10	73·0	15	16	11·9	20	55	93
7063	9	13	66	9	9	72·6	15	19	15·4	18	53	92
7065	9	13½	66½	9	10	73·2	15	17	12·8	18	54	91½
Class 1103 (Strong Flour, White).												
7070	10	13	66¼	9	10	74·8	15	15	11·3	20	55·4	92
7072	10	12	65	9	9	71·5	15	18	14·3	18	54	91
7074	10	13½	66¾	9	9	71·7	14	16	12·6	17	52·6	88½
Class 1104 (Medium Strong Flour).												
7099	10	15	68	10	10	73·2	14	15	11·1	14	50	88
7089	8	14	67¼	10	10	73·0	13	15	11·6	12	48	82
7080	8	13	66¼	10	10	73·0	15	14	10·2	11	47·2	81
7082	9	14	67¼	10	10	75·3	15	12	8·2	11	47	81
7071	8	12	65¼	10	10	74·4	15	14	10·5	12	47·8	81
7081	9	13	66	10	10	73·2	14	14	10·4	10	45·8	80
7079	9	14	67¼	10	10	74	12	14	10·6	10	46	79
Class 1105 (Florence Special).												
7106	10	13½	66¼	10	10	75·5	13	16	12·4	14	49·6	86½
7115	9	14½	67½	10	10	75·8	14	15	11·8	14	49·6	86½
Class 1108 (Hard Federation Special).												
7126	9	12	65	10	10	73·6	15	16	11·8	14	50	86
7131	9	11	64	10	9	72·8	14	18	14·5	12	48	83
7132	10	13	66¼	10	10	74·6	12	14	10·5	14	50	83
Class 1109 (Weak Flour).												
7152	9	12½	65¾	10	10	74·6	15	15	11·3	9	45	80·5
7140	10	14	67¼	10	10	73·1	14	14	10·2	7	43·6	79
7143	9	13½	66½	10	9	72·4	13	15	11·0	8	44	77·5
7144	9	13½	66½	10	9	71·6	14	11	7·4	9	45·4	75·5
7145	8	11½	64½	10	8	71·2	13	13	8·9	7	43·6	70·5

RESULTS OF EXAMINATION OF THE WHEATS IN CLASSES WHICH WERE NOT SUBJECTED TO MILLING TEST.

Catalogue No.	Variety.	Weight per bushel.		Appearance of Grain.	Trueness to Type.	Uniformity.	Total.
	—	Points Awarded.	Actual Weight.	—	—	—	—
	Maximum Points.	15		10	10	10	45
	Class 1101 (Macaroni Wheat).						
			lb.				
7058	Huguenot	13	66	9	9	9	40
7059	Medeah	13	66	9	8	8	38
	Class 1110 (Collection of Five Farrer Wheats).						
153	Bomen	12	65	9	9	9	39
	Canberra	14	67¼	10	10	10	44
	Clarendon	13½	66¾	10	10	10	43½
	Florence	13½	66½	9	10	10	42½
	Rymer	13	66¼	9	9	9	40
							209
7155	Canberra	12½	65¾	10	10	10	42½
	Cedar	13½	66½	10	10	10	43½
	Comeback	13	66	10	10	10	43
	Florence	14	67¼	10	10	10	44
	Hard Federation ..	13½	66½	10	10	10	43½
							216½
7156	Bobs	13	66¼	10	10	10	43
	Cedar	13	66	10	10	10	43
	Comeback .	13	66	8	10	10	41
	Federation . .	12½	65¾	6	8	10	36½
	Jonathan . ..	11½	64½	6	10	10	37½
							201
	Class 1111 (Collection of Five Non-Farrer Wheats).						
7157	Billy Hughes	12½	66¾	8	9	10	39½
	Currawa .	13½	66½	10	10	10	43½
	Purple Straw ..	13	66	9	9	8	39
	Steinwedel ...	14	67	9	9	9	41
	Yandilla King ...	13	66	8	9	9	39
							202
7158	Huguenot .. .	12½	65½	8	10	10	40½
	Medeah .. .	12½	65½	6	10	10	38½
	Petatz Surprise ...	13½	66¼	6	10	10	39½
	Pusa 104	12½	65½	6	10	9	37½
	Pusa 107	12½	65½	8	10	9	39½
							195½

Awards.

Class 1101— Macaroni.	First Prize, No 7058—S. Pollock; Huguenot; grown at Quirindi on red soil; seed per acre, 45 lb.; yield per acre, 21 bushels; no rain record; autumn ploughing. Second Prize, No. 7059—S. Pollock; Medeah; grown at Quirindi on red soil; seed per acre, 45 lb.; yield per acre, 19 bushels; no rain record; autumn ploughing.
Class 1102 — Strong Red.	First Prize, No. 7067—S. Pollock; Cedar; grown at Glengarry, Quirindi, on black soil; seed per acre, 45 lb; yield per acre, 17 bushels; no record of rainfall; autumn ploughing. Second Prize, No. 7061—D. and J. Gagie; Cedar; grown at West Wyalong on red soil; seed per acre, 50 lb; yield per acre, 16 bushels; rainfall during growth, 7·61 inches; autumn ploughing.
Class 1103 — Strong White.	First Prize, No. 7070—D. and J Gagie; Comeback; grown at West Wyalong on red soil; seed per acre, 50 lb.; yield per acre, 12 bushels; rainfall during growth, 7·61 inches; autumn ploughing. Second Prize, No. 7072 A. R. Michael; Comeback; grown at Woomelang (Vic.) on sandy loam; seed per acre, 40 lb.; yield per acre, 25½ bushels; rainfall during growth, 8·33 inches; fallow.
Class 1104— Medium Strong.	First Prize, No 7099—W. H. Scholz; Quality; grown a Gilgandra on sandy loam; seed per acre, 45 lb.; yield per acre, 27 bushels; rainfall during growth, 17 inches; autumn ploughing. Second Prize, No. 7089 J. T. Maunder; Sicilian Wonder; grown at Pallamallawa, on chocolate loam; seed per acre, 45 lb.; yield per acre, 33 bushels; rainfall during growth, 19·9 inches; short fallow.
Class 1105— Florence Special.	Special Prize, No. 7106—D and J. Gagie; grown at West Wyalong, on sandy loam; seed per acre, 60 lb.; yield per acre, 31 bushels; rainfall during growth, 8·1 inches; autumn ploughing.
Class 1106— (Novice) Federation Special.	Special Prize, No. 7116 J. W. Eade; grown at Euchareena, on chocolate loam; seed per acre, 45 lb.; yield per acre, 40 bushels; no record of rainfall; fallow.
Class 1107— Federation Special.	Special Prize, No. 7121 -Estate of late T. Bragg; grown at Mungeribar, on red soil; seed per acre, 45 lb.; yield per acre, 12 bushels; rainfall during growth, 4·5 inches; autumn ploughing.
Class 1108— Hard Federation, Special.	Special Prize, No. 7126—Estate of late T. Bragg; grown at Mungeribar, on red soil; seed per acre, 45 lb.; yield per acre, 12 bushels; rainfall during growth, 4·5 inches; autumn ploughing.
Class 1109— Weak Flour.	First Prize, No. 7152 -S. Pollock; Petatz Surprise; grown at Glengarry, Quirindi, on sandy loam; seed per acre, 45 lb.; yield per acre, 19 bushels; no record of rain; autumn ploughing. Second Prize, No. 7140—J. W. Eade; Currawa; grown at Euchareena, on chocolate loam; seed per acre, 45 lb.; yield per acre, 33 bushels; no record of rainfall; new ground.

Awards—*continued.*

Class 1110—

Collection of Five Farrer Wheats.

First Prize, No. 7155—D. and J. Gagie: Cedar, Comeback, Florence, Canberra, Hard Federation; grown at West Wyalong, on red clay; seed per acre -Cedar and Comeback 50 lb.; Florence, Canberra, and Hard Federation, 60 lb.; yield per acre—Cedar, 16 bushels; Comeback, 12 bushels: Florence, 31 bushels; Canberra, 22 bushels; Hard Federation, 15 bushels; rainfall during growth—Cedar and Comeback, 7·6 inches; Florence and Hard Federation, 8·1 inches; Canberra, 7·4 inches; autumn ploughing.

Second prize, No. 7153 -Mrs. J. Berney; Rymer, Canberra, Bomen, Clarendon, Florence; grown at Eurimbla on red loam; seed per acre, 50 lb.; yield per acre -Rymer, 28 bushels: Canberra, 30 bushels; Bomen, 23 bushels: Clarendon, 21 bushels; Florence, 20 bushels; rainfall during growth, 13 inches; fallow.

Class 1111—

Collection Five non-Farrer Wheats.

First prize, No. 7157—Mrs. J. Berney; Currawa, Purple Straw, Steinwedel, Billy Hughes, Yandilla King; grown at Eurimbla on red loam; seed per acre, 50 lb.; yield per acre—Currawa, 31 bushels: Purple Straw, 24 bushels; Steinwedel, 25 bushels; Billy Hughes, 22 bushels; Yandilla King, 23 bushels; rainfall during growth, 13 inches: fallow.

TABLE showing average bushel-weights, gluten-content, and water-absorbing power of wheats of the "Strong White" and "Soft White" classes milled at the Royal Agricultural Society's Show, from 1905-1922.

Year.	Weight per bushel		Gluten		Flour Strength. (Water-absorption, quarts per 200 lb. sack.)	
	Strong White	Soft White.	Strong White.	Soft White	Strong White	Soft White.
	lb.	lb.	per cent.	per cent		
1905	63	64	10·0	9·7	46·6	45·2
1906	63¾	64½	11·0	9 8	48·5	45·7
1907	62½	66	9·3	8·3	48·4	45·4
1908	64½	65	12·2	10·2	52·5	46·4
1909	64¾	65¼	11·9	8·6	53·5	49·2
1910	64½	64	13·8	12·1	50·0	47·8
1911	64½	63½	12·5	11·0	53·4	47·0
1912	65	64	13·4	10·6	52·7	45·2
1913	67	65¼	15·2	11·7	53·1	46·9
1914	67¾	67	12·8	10·6	52·3	45 0
1915	67½	66½	13·1	12·4	53·8	45·7
1916	67¼	67¼	13·0	12·3	53·3	47·5
1917	66	67½	12·4	8·6	54·6	43·0
1918	67	65¾	*	10·2	*	44 5
1919	67½	66¼	10·5	8·9	52·7	43·6
1920	67	65½	13·6	11·5	51·3	44·7
1921	66	64¼	13·0	11·0	52·6	45·1
1922	66	66	12·7	10·0	54·0	44·3

* There were only two entries in the Strong White class in 1918, and these were readily differentiated by the judges without subjecting them to a milling test. The figures for gluten and flour strength are therefore not available.

The above table shows that the quality of our wheat, as far at all events as show samples are concerned, maintains itself well. Both in gluten content and in flour strength there is a gradual but marked improvement in the eighteen years covered by the table, especially in the strong-flour class.

The Domestic Rats.

WITH SUGGESTIONS FOR THEIR CONTROL IN FIELD AND BARN.

THE BROWN RAT (*Rattus norvegicus*) AND THE BLACK RAT (*Rattus rattus.*)

W. W. FROGGATT, F.L.S., Government Entomologist.

THESE two rats have been known under different names. The "brown rat" is better known under the name of *Mus decumanus*, and the "black rat" under the name of *Mus rattus*. Latest authorities, however, have changed their scientific names, and they are now defined as members of the genus *Rattus*, and the specific name of the brown rate, *decumanus*, gives place to *norvegicus*.

The popular name of "brown rat" is also now somewhat misleading, for under domestic conditions it has developed into almost a black variety, which, however, is quite distinct from the true black species, *Rattus rattus*, though sometimes confused with it. Though closely allied both in structure and habits, they are two well-defined species. The brown rat lives in the basement of houses, frequents sewers, and is more of an offal feeder. It does not climb so well as the black rat, and it is more shy and retiring. The smaller black rat does not vary much in colour, and is considered more as a house rat. In Europe it is found frequenting the ceilings and walls of houses instead of the basements, and it is not fond of water as the brown rat is. The brown rat has been known under several popular names. It was called the "Norway rat" because there were so many on the timber ships coming to English ports from Norway and Russia.

Ships are admirably constructed to spread rats all through the ports of the world, and with the spread of commerce even isolated islands soon become overrun with the pests. The recent very serious infestation of Lord Howe Island is a striking example of how rats gain a footing in isolated spots, and of the damage they can do where they have no enemies and where food supplies are unlimited. Until three years ago rats were unknown on Lord Howe Island, but at that date the s.s. "Makambo" had the misfortune to run on a reef, and all the cargo, in which some rats were evidently concealed, was stored on shore until she could be refloated. Since then the rats have increased into countless thousands; they are not only destroying all the bird fauna of the island, but they bid fair to destroy all the palm seeds, the collection and export of which is the sole support of the islanders.

Rats are a very serious menace to commerce and human life—first, on account of the millions of pounds worth of foodstuffs they destroy; and second, on account of their being the active agents in spreading bubonic plague. During the investigations regarding the outbreak in Sydney of bubonic plague in 1909, all the first cases of plague development were traced to rats that had moved up into the city from the wharves, and to the infected fleas carried by the rats. One of the difficulties in dealing with rats in a city like Sydney is that the water fronts are constantly being reinfested from the incoming ships. In spite of all precautions, ships are admirably adapted for protecting rats, and few ships are free from them.

The study of the balance of power and of the adaptability of animals to new surroundings or to changed conditions of life is very interesting to the economic zoologist. This is particularly so when we investigate the rat problem and the habits acquired by the rodents under domestic conditions. The rat was once a wild woodland animal, at the mercy of its many natural enemies, such as ferrets, stoats, weasels, wild cats, and foxes, not to mention the night-hunting owls and hawks. Living thus under natural conditions it was kept in check. When, however, it adopted man and made its home, first in barns and stacks, and finally in our houses, it found a comparative absence of enemies and unlimited food. Behind the wainscot of the drawing-room, hunting over the kitchen floor, feasting in the slaughterhouse yard, or swimming across the underground sewer, the rat is equally at home. He can eat through a lead pipe, excavate a passage under a brick foundation, climb along a slender rope, or nibble his way through a stout board without any great exertion, when hunting for food.

The fecundity of the female rat is remarkable. The young female breeds when she is 4 months old and before she is full grown. Though the first family consists of from three to five young ones, as she increases in age if food is abundant the more mature animal often gives birth to ten young ones, and there are records of fifteen or sixteen in a litter. The female breeds all the year round, and under normal conditions she has five or six families in the year. It is not, therefore, difficult to understand how, under suitable surroundings, rats increase and multiply until they often outnumber the inhabitants of our large cities, eating and destroying hundreds of thousands of pounds' worth of food every year.

Numerous as rats are under present conditions, it is hardly conceivable how they would multiply if it were not for the fact that rats are cannibals. They not only eat all injured or sick brothers, but the old bucks eat also the young ones in the nests. Nature's grim law of tooth and claw is what balances the power of reproduction.

Modern writers have estimated that the rat population of Great Britain and Europe is equal to the human beings, and that, taking the cost of their keep at ½d. per day, the foodstuffs destroyed would total a value of £15,000,000 per annum at pre-war prices, or nearly double that at the present rates.

The damage caused by rats in Sydney, both in warehouses and private dwellings, must run into hundreds of thousands of pounds every year, and similar destruction of food is going on in the same proportion in every country town.

It is not only on account of the direct damage that the rat does in destroying food supplies that the rat should be hunted and destroyed by every means in man's power. He and his parasitic fleas play a most important part in the spread of that deadly scourge of the East—bubonic plague. Infected by plague germs through his unclean surroundings, he is also infested with several species of fleas. These fleas suck up the germ-laden blood of their host and can carry the infection into the blood of the first human being they bite. When in an unhealthy condition rats seem to be more suitable hosts for fleas than healthy normal ones, but when the rats die the fleas leave their fur and find fresh hosts often accidentally, in human beings who are working in infested areas. Therefore we have to fight both rats and fleas in times of bubonic plague.

Trapping.

In the ordinary residence, rats are usually casual visitors, and can be easily caught with a horse-shoe bow or a break-neck trap if properly set and baited. When evidence of a rat's presence is noticed in a house, all food and all scraps should be carefully covered, so that no food is obtainable in either the house or the yard. One of the best baits the writer finds is a cube of freshly-roasted steak, fixed into the hook so that the rat cannot drag it off without using force; he has to tug the bait and thus releases the metal ring on the spring. A little grain or pollard scattered round on the floor where the rats come into the room for a night or two before the baited trap is placed in position, attracts the visiting rat to the same place, and, finding no loose food, he comes to the trap. A few drops of aniseed oil sprinkled at the trap, but not on the bait, also attracts the rat.

A number of different traps are on the market, but all will catch rats if properly set and baited, provided the hungry rats cannot get at any other unprotected food.

A hundred years ago, when ratcatchers were numerous, they used to work on a regular system in trapping. When operating in a family mansion, a ratcatcher would feed the rats in the basement in large double-ended traps, fixed so that the rats could run through them and find food and shelter. When sufficient time had elapsed for all the rats in the neighbourhood to find out where these free rations were being distributed, all the traps were set with no food outside, and rats came into the traps, but could not get out. The catcher went round several times during the night and released the imprisoned rats into a receiving wire rat-trap, constructed for this purpose, and then reset the double-ended wooden traps, and usually made a clean sweep of the rats in the one night.

The writer has a very old manual written by a professional ratcatcher over a hundred years ago. In this he gives the following formulas that are worth reproducing:—

No. 1 Formula—
20 drops of rhodium.
7 grains of musk.
½ oz. of oil of aniseed.

Shake the mixture well up, and anoint each end of the trap; dip a piece of paper in the mixture and drop it in the trap.

No. 2 Formula—
1 lb. of flour.
3 oz. of treacle.
6 drops of caraway seed oil.

Mix well up in a bowl, and then add 1 lb. of crumb of bread. (This was scattered about as the free rations for the rats before the traps were set. When baiting the traps the same mixture was used without the addition of the bread.)

Rats in Paddocks and Stacks.

The writer is especially interested, however, in rat and mice plagues in country districts, and those in our stacks of bagged wheat. At irregular intervals we have, in Australia, mice and rat plagues. These rodents appear in the country as if by magic, in armies of countless millions. Usually they start in the western scrub lands, travel eastward, and spread over the cultivated farms. They eat the maize and grain in the paddocks, and swarm into the stacks, granaries, and homesteads. The most notable and widespread mouse plague was that of 1917 18, when all the country railway sidings were covered with great stacks of bagged wheat in north-western Victoria and south-western New South Wales, waiting for transport to the ports. In this great area the mice took possession. They ate and destroyed at the very lowest estimate over £1,000,000 worth of wheat in New South Wales alone, and probably nearly as much in Victoria also. These mice were not counted when destroyed, but it was estimated by weight at Minyip, in Victoria, that 5½ tons were captured in water traps in three days. At Berrigan, New South Wales, the officer-in-charge killed over 40,000 every night for a week at the wheat stacks.

The most effective trap used at the wheat stacks was made in the following manner:—Four 9-feet sheets of galvanised iron were placed on edge to form a square, with a stout piece of pointed quartering driven into the ground in each corner to which the iron was securely nailed. Earth was then dug up and thrown against the outer surface until it was level with the top of the iron, sloping backwards and surrounding the square iron-screened pit. Kerosene tins, half full of water, were sunk level in the ground inside the trap at each corner, and a few pounds of wheat, or wheat and pollard, were thrown in the centre of the pit. The mice, looking for food, swarmed over the embankment and fell into the trap, and as they displaced each other they fell into the water tins and were either drowned or smothered as the tin filled up.

Such a trap could be moved and built up in a new area as desired.

In the inland districts from Tamworth in the north to Wagga in the south, mice and rats have appeared this present season. In some places the mice are most numerous; in other places, the rats are the pest. Both species have invaded the maize paddocks in the north, and everything is being eaten out in some districts: The writer was informed that when other food was short even the young shoots of grass after rain were nibbled off by the countless swarms of mice.

In the country districts, one of the most effective methods of dealing with rat and mice plagues is poisoning with cyanide water, at the rate of 1 oz. of cyanide to 4 gallons of water. The cyanide water is placed in shallow dishes: roof guttering, if soldered up at the ends and placed in position in the ground, makes a handy water trough. All local water should be closed to the rats and mice sheltering in the stacks, outhouses, and fields. The dishes when first placed out should be filled with good clean water to which the rats and mice should have free access; when they have found the new supplies and have come regularly, say in four or five days, the clean water should be thrown out and the poisoned water placed in the troughs and dishes just before the first mice come out in the evening. The action of the cyanide is very quick, and the rodents do not get very far away after drinking. When the poisoning is finished, these dishes and guttering troughs should be very thoroughly cleaned, or, if much corroded, they should be burnt and buried.

Poisoning Rats.

The chief factor in successfully poisoning rats is much the same as that in trapping them. Get them used to coming to a certain place for food, and put out food for them in that place for several days before laying the poison baits. At the same time shut off all other food supplies, and see that no other food is left lying about the place. The more carefully this is done the more effective will be the destruction of the pest. The objection to the use of poison baits, particularly in a house, is that the poisoned rats very often manage to crawl away under floors and to obscure corners where they are very difficult to get at and remove. The smell from dead rats often makes it necessary to take up the floors.

Where rats can be poisoned without much danger of their becoming a nuisance, quite a number of poisons have been used effectively. Those poisons that kill rats most rapidly are the ones most in favour. It must be noted, however, that though the contrary is often stated, there is no poison that will dry up the body of a rat and render it odourless. It is always advisable to place a pan of water in the vicinity of any poison baits. Both rats and mice usually drink after eating, and drinking accelerates the action of the poison, and the aim should be to get a poison that acts rapidly before the rats can reach cover, and to spread it in an open space so that poisoned rats can be collected and buried or incinerated.

Strychnine is one of the most rapid and deadly poisons for rats and mice in a house, and if the saucer containing the poisoned bait is placed in the centre of the infested room or basement, the victims will not get very far away. In the United States, where field rodents, such as ground squirrels, gophers, and many field rats, as well as domestic rats, are very destructive on the farms, both dry and moist poison baits are used. The two following formulas are recommended in the United States Department of Agriculture Farmers' Bulletin 670 :—

Dry Grain Formula—

1 oz. powdered strychnine.
1 ,, bicarbonate of soda.
⅛ ,, saccharine.

Mix thoroughly in a paper box and dust it over 50 lb. of crushed wheat or 40 lb. of crushed oats in a metal tub (kerosene tin will do). This tin should be burnt and buried when it has been used up.

Wet Grain—

1 oz. strychnine sulphate dissolved in 2 quarts of boiling water.

Dissolve 2 tablespoonfuls of laundry starch in half a pint of cold water.

Add the strychnine solution, and boil for a few minutes until the starch is clear.

A little saccharine may be added, but is not essential.

Pour the hot mixture over 1 bushel of oats in a metal tub and stir thoroughly. Let the oats stand overnight to absorb the poison.

As this bait is deadly to anything, besides rats and mice, that may eat it, all care must be taken when putting it out on boards, shallow dishes, or tins, that these receptacles are gathered up every morning and locked up when not out for bait.

Barium carbonate is a cheap and safe poison to use against rats and mice. It is stated to be harmless to stock and man, while most effective against rodents; but Mr. Wright has pointed out that this is only partly true, and that any rat poison with barium as a component part should be kept out of the reach of children. He says: "While carbonate of barium is insoluble in water, the acid secretions of the human stomach form soluble and poisonous compounds with this chemical, and hence may lead to fatal results." Barium carbonate is tasteless, and a bait containing from 2 to 2½ grammes of it in 12 grains of dough will kill a rat.

The rat inspectors working under the Mouse and Rat Act, 1919, in the different counties in England, have used the following formulas:-

No. 1 Formula—

6 oz. barium carbonate.
4 ,, dripping.
½ ,, salt.
16 ,, meal.

This makes 1,000 baits of 6 grains each, spread in pieces as large as a hazel nut.

No. 2 Formula—

4 oz. barium carbonate.
4 ,, biscuit meal or plain meal.
5 drops of oil of aniseed.

Mix with fat or dripping into pellets the same size as in No 1 Formula.

No. 3 Formula—

50 per cent. tallow.
50 ,, ,, barium carbonate.

Mix with dripping and spread as a paste on bits of bread.

Squills. Another rat poison that has come into prominence of late years is sold under the name of "syrup of red squills," of which there are various forms. This is made from the bulbs of *Scilla maratima*, a seashore plant. The powdered bulbs are also used.

The formula given by the English county inspectors, and which they claim has been very effective, is as follows:—

Red Squills Formula—

20 per cent. red powdered squills.
30 ,, ,, breadcrumbs.
30 ,, ,, fat.
20 ,, ,, syrup.
6 drops of oil of aniseed.

Crumble up the bread and mix the whole into a paste and cut up into baits about the size of a hazel nut.

This bulb is poisonous to rats, but the raw bulb when chopped up soon loses its deadly qualities. Cooking the bait increases its keeping properties. Powdered bulbs are poisonous; of such powder 1 to 2 grains is the minimum charge for a bait for a full-grown rat.

Dr. Ferguson informs me that the Board of Health has used this poison, but it has been found very variable and unsatisfactory in its results. The present price, as quoted in the *Chemist and Druggist*, would render its use on a large scale prohibitive in Australia.

Arsenic is one of the cheapest and most effective poisons in killing out many different pests. It has been largely used in food baits or in poisoned water for the destruction of rats and rabbits. As regards rats it has been found very variable in its action, and if rats recover from a dose they will not take another bait. Powdered white arsenic mixed with any suitable bait, at the rate of 1 oz. of arsenic to 12 of meal or pollard, and made with fat into baits or spread on bread is placed in their runs.

Phosphorus, mixed with pollard and other food baits, under many different names, is one of the chief poisons used with the poison cart for poisoning rabbits by station owners in their paddocks. The Sydney Health Department's officers state that phosphorus paste is one of the best methods for poisoning rats in the city and suburbs, and in an outbreak of bubonic plague some years ago chip boxes of phosphorus paste were freely distributed to all householders. The present writer's personal experience was that most of his sample was eaten by the large cockroaches that visited his cellar.

All the approved poisons have been noted and described, but at present there seems to be a concensus of opinion that the use of barium carbonate has been so successful and the results so constant that it is the one that can be specially recommended. The fact that it is not poisonous to anything else but ground vermin, such as rats and mice, is also greatly in its favour. There is also a certain amount of danger when careless persons are handling strychnine or arsenic.

Poisoning can be carried out in the country with better results than in the house and store; but (as in the house) the more the food supplies are shut away from the pests, the more easy it is to poison the hungry rodents.

(*To be continued.*)

VALUE OF RECORDS OF LOCAL HONEY FLORA.

THE bee-keeper will find it worth his while to pay close attention to the appearance of local honey plants and trees. If he observes them carefully just now, for instance, he will be able to form a fairly good idea of the honey prospects for the coming season, for buds will generally be showing freely on the trees that are going to flower.

Not only should the bee-keeper observe the appearance of local flora—he should systematically record his observations. To have a general knowledge of the flowers—to know the flowering periods and the value of the blossom from a honey-producing point of view, and in the light of this knowledge to be able to look with certainty a little way ahead—is to be able to prepare one's colonies so as to make the very best use of the honey flow. Carefully compiled records have a great advantage over mere mental notes; many trees do not flower every season, and the points worth recording concerning the different species are far too numerous to memorise. The records should include the botanical as well as common names.—W. A. GOODACRE, Senior Apiary Inspector.

Two Investigations in Relation to Sprays.

A. A. RAMSAY, Principal Assistant Chemist.

Of the investigations carried out recently by this branch of the Department, two have been of significance in relation to spraying The first affects the preparation of home-made tobacco wash, and the utility or otherwise of using washing soda in its preparation; the second refers to the feasibility of a treble-purpose spray embodying tobacco, lead arsenate and Bordeaux mixture.

A Tobacco Wash Experiment.

Two formulæ were made the subject of comparison in the first experiment —(*a*) consisting of 10 lb. waste tobacco, 5 oz washing soda, and 30 gallons water; and (*b*) consisting of the tobacco waste and water only. Since the washes were to be used for further experiments, they were made actually twice as strong as indicated by the formula. The waste tobacco stalks used were obtained by purchase in the ordinary market, and contained 1·35 per cent. nicotine.

Preparation (*a*) was obtained by treating 10 lb. of stalks with ·115 lb. anhydrous sodium carbonate (the equivalent of 5 oz. or ·312 lb. washing soda) in 15 gallons of water. The tobacco was steeped for 24 hours in hot water and allowed to cool. Preparation (*b*) was prepared similarly to (*a*), except that the sodium carbonate was omitted.

Both extracts when prepared showed an acid reaction, (*b*) being more acid than (*a*), thus:—

1,000 cc. of (*a*) would require ·901 gram sodium carbonate to make it neutral.

1,000 cc. of (*b*) would require 1·325 gram sodium carbonate to make it neutral.

Since there had already been ·77 grains sodium carbonate added to (*a*), the total used was 1·67 grams, whereas in (*b*) only 1·33 grams would have been necessary. The total dry extract obtained from 1,000 cc. (*a*) was 24·434 grams, and deducting the 0·77 grains sodium carbonate added. gave a dry extract of 23·664 grams. The total dry extract obtained from (*b*) was 24·742 grains per 1,000 cc.

The volume of fluid extract obtained was in both cases about 795 cc.; or, expressed in another way, about 80 per cent. of the water used was obtained on draining the stalks, the remaining 20 per cent. of the water having been absorbed and retained by the stalks.

The conclusion to be drawn from the above experiment is that there appears to be little advantage in using washing-soda in the preparation of home-made tobacco infusions.

A Triple-purpose Spray Experiment.

The second experiment constituted an attempt to develop the double-purpose spray, an account of experiments with which was published in this *Gazette* in June, 1917, p. 435. The aim of the experiment was to ascertain if any harmful compounds were formed in a mixture consisting of Bordeaux mixture, lead arsenate, and tobacco.

Equal volumes were mixed (1) of Bordeaux mixture (6–4–22) and the tobacco extract (*a*) in the above tobacco wash experiment, and (2) of Bordeaux and the tobacco extract (*b*); to each of these mixtures lead arsenate was added at the rate of 2 lb. to each 50 gallons of the mixture, the resulting mixtures being then shaken up at frequent intervals over a period of 2½ days.

Immediately after mixing, the mixed spray containing tobacco infusion (*a*) showed that traces of copper were present in the clear filtrate, but after an hour no trace of copper in solution was present, and after standing for two and a half days faint traces of copper in solution were present, but the magnitude of this would be indicated by ·000. One hour after mixing the combined spray, of which tobacco infusion (*b*) formed part, traces of copper were present in the clear filtrate, but after the lapse of an hour these disappeared, and they did not at any time reappear. At the end of two and a half days the clear filtrate from both these combined spray mixtures was examined for soluble arsenic compounds, with the following result:—

Soluble arsenic (expressed as As_2O_5) present per 1,000 cc. mixture when tobacco infusion (*a*) was used ... ·0153 grams.

Soluble arsenic (expressed as As_2O_5) per 1,000 cc. mixture when tobacco extract (*b*) was used ... ... ·0077 grams.

The amount of water-soluble arsenic compounds allowed by the United States regulations if lead arsenate and water alone are used is limited to ·030 gram per 1,000 cc.; the amounts actually found in the suggested triple sprays are much below this limit, and there is nothing to indicate that any harmful results would accrue. At the same time it should be noted that preference should be given to tobacco infusion (*b*) (that is, one made without the addition of soda) when compounding such a triple spray.

FERTILISER TRIALS WITH MAIZE FOR SILAGE.

DURING the past season experiments were conducted at Yanco Experiment Farm which indicate the great value of superphosphate in relation to maize for silage. An application of 1¼ cwt. superphosphate resulted in a yield of 12 tons 19¼ cwt., as against an average of 10 tons 16¼ cwt. on the unfertilised check plots. Estimating the green maize as worth £1 for silage purposes, and charging 8s. 4d. for the superphosphate, the monetary gain from the treatment was £1 14s. 8d.

Packing House Appointments.

W. J. ALLEN AND W. LE GAY BRERETON.

THE planning and equipping of the packing house is a subject to which only limited attention has been paid by many orchardists in the past, but the demands of the industry have expanded a good deal in recent years, and there are now many growers and packers who are taking into serious consideration the arrangement and equipment of the shed with a view to the greatest possible economy in labour and time. The ideal arrangement, of course, is that which provides for the fruit passing through the various operations in an orderly way, moving in one direction from the receiving point to the store or the waggons.

The arrangement of the equipment in the shed, of course, will vary according to the design of the shed, the fruit, and the methods adopted for handling it, but much can be done by conveniently arranging the equipment to ensure economy in the working of the shed.

Except where the walls of the shed are provided with shutters or windows through which the packing benches can be filled from the outside, it is generally not convenient to have the benches placed along the walls. It is better to have them some distance from the walls, leaving space for the fruit to be stacked behind the benches in the cases in which it has been drawn from the orchard. If a "sizer" is used it should be placed between the stack and the packing bench. The fruit can then pass from the sizer to the correct divisions of the packing bench.

When the cases are packed they pass forward to the press or other means for nailing down, stencilling, &c., and may go straight on to the waiting cart or lorry at the despatching door, or they may be stacked in a space reserved convenient to this door. In this way the fruit is passing at each operation from the receiving door towards the despatching door.

The accompanying plans of benches, trolleys, and presses have been prepared by Mr. A. Brooks, Works Overseer of the Department.

The Packing Bench. (Fig. 1.)

The fruit is turned out on these benches when it is to be packed. Handled in this way, it is more exposed than if packed direct from the picking boxes, and is more quickly and easily handled by the packer. The drawing shows a bench 12 feet in length, which gives ample room for three packers to work. Of course, benches can be made any length to suit the shed and number of packers, but as a rule it is preferable not to have the benches too long, so that each bench can be shifted about independently, as the varying conditions of the stacks of fruit may necessitate rearrangement from time to time. Some packers prefer a wider bench than that shown above, even to 3 ft. 6 in. or 3 ft. 8 in., but if the bench is too wide it makes too great a stretch for the

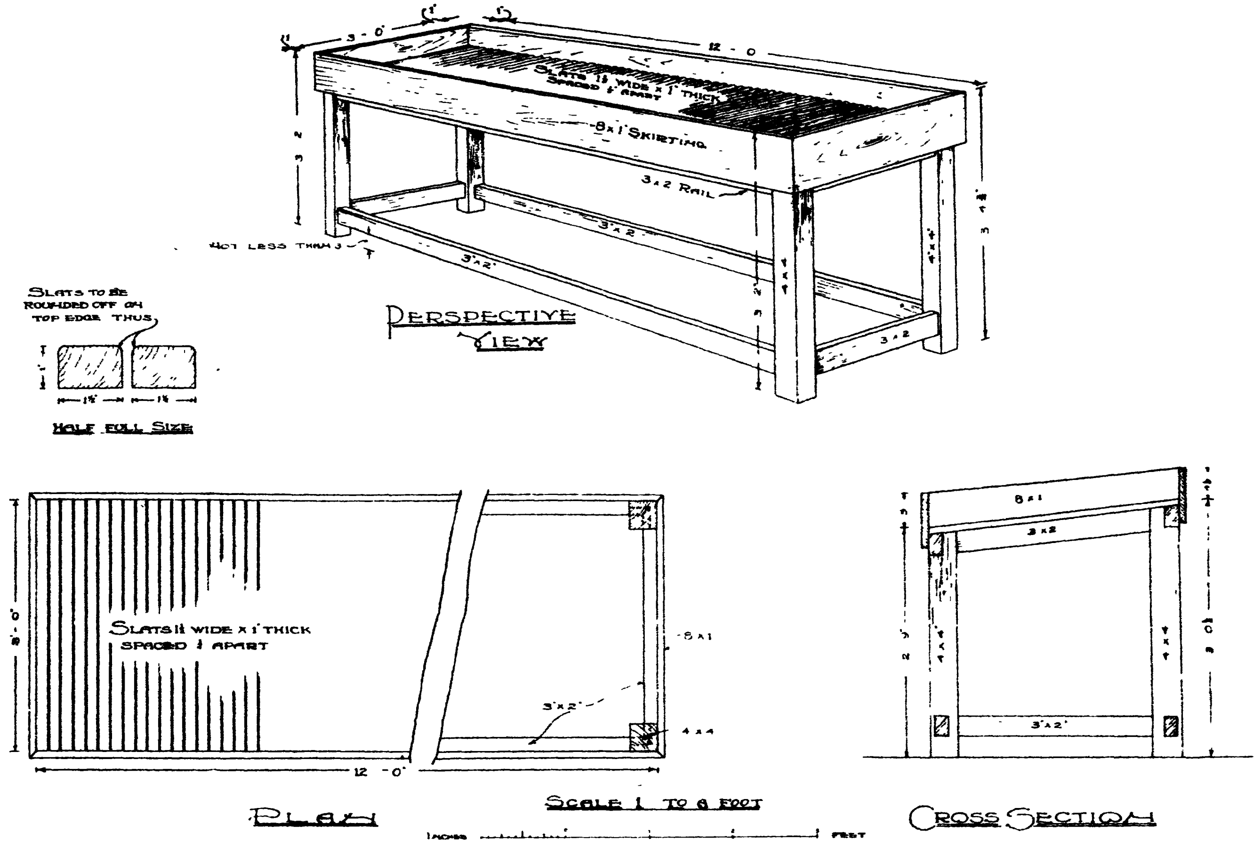


Fig. 1.—Plan and Details of a Fruit Packing Bench.

packer, especially when he is wrapping and has to reach to the opposite side of the case to pick up the paper. It will be noticed that the bottom of the bench is inclined towards the packer. This is in order that the fruit may work automatically towards him. Care should be taken that the pitch of the incline is not overdone, or as the bench becomes empty the fruit will run from the back with too much force and will bruise itself against the skirting in front.

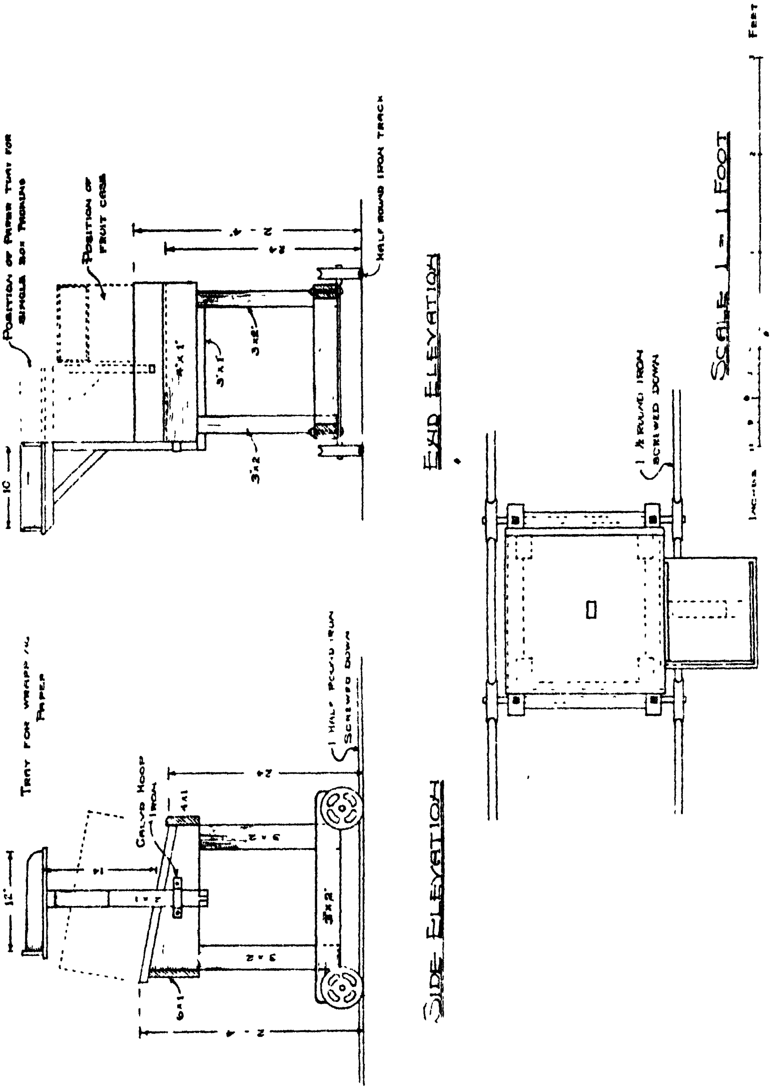


Fig. 2.—Plan and Details of Packing Case Trolley.

The bottom is composed of slats, rounded on the top edges and spaced apart to allow any leaves, broken spurs, &c., that come in with the fruit to fall through. The slats can be cleated in sections, so that they can be lifted out for cleaning. This is advantageous, as it allows for thorough cleaning and destruction of any codlin moth grubs that may have emerged from infected fruit and that are hiding about the bench. All joints of the framework should be tight fitting so as not to afford hiding places for codlin moth grubs.

Some packers prefer a canvas or sacking bottom to the bench. This can be provided for quite simply by leaving out the top rails of the bench, and depending only on the skirting, screwed on to the legs. A crosspiece may be necessary to prevent the skirting from drawing together. A sheet of canvas, or grain bags, is then loosely stretched over the top, so that it will sag towards the centre. It is a mistake to allow it to sag too deeply.

The sheet should be fastened with cleats along the outside of the skirting, so that it can be removed from time to time for cleaning and for the destruction of any codlin moth grubs that may be sheltered by it.

The framework of such a bench need not be tilted towards the packer, and if desired it can be made wider so that packers can work from both sides of the bench.

One grower on the Northern Tableland constructed a very serviceable canvas bottom bench by putting the canvas over the top rail of the framework and the wooden skirting above it. One side of the skirting could be lifted out to allow of the clearing of the canvas of leaves, broken spurs, &c.

If the fruit is sorted either by hand or machine before packing, the bench should be provided with divisions to take the various sized fruits, and it is preferable to have such division adjustable.

The Packing Trolley. (Fig. 2.)

As some packers prefer to work two cases, a trolley has been designed to take two Australian bushel cases, and the paper tray may be adjusted to suit either double or single-case packing. By providing other slots it could be shifted to suit the Canadian or cases of other widths. The paper tray should be close up to the outside edge of the case. If it is required for single-case packing only the whole construction could be made narrower.

The mounting on wheels, so that it will move easily along the side of the bench, is of great assistance when packing fruit that has not been previously sized, as when a packer has exhausted the size he is packing he can shift along slightly and bring more of the size within reach. Even plain wheels are preferable to none, but the flanged wheel is the best, as the trolley cannot run away from the bench. The rails should be set so that the trolley will carry the case with just sufficient clearance between it and the skirting of the bench, the object being that the packer should be able to reach the wrapping paper with one hand and the fruit from the bench with the other hand, without having to stretch too much.

When packing fruit that has already been sized, the wheels, of course, are not necessary. Some packers like the case at a greater tilt than is shown in drawing. This can be obtained by placing a block of wood under the end of the case.

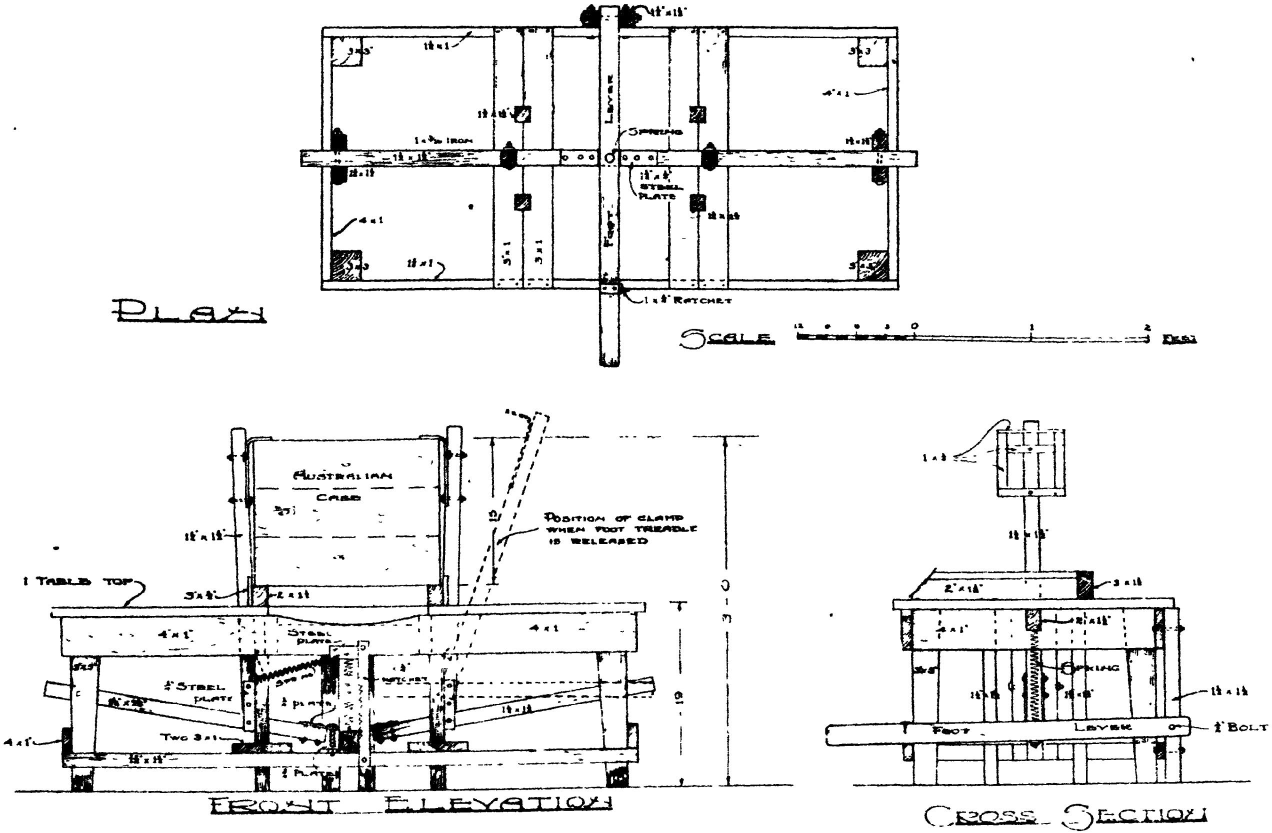


Fig. 8.—Working Drawings of a Case-nailing Press.

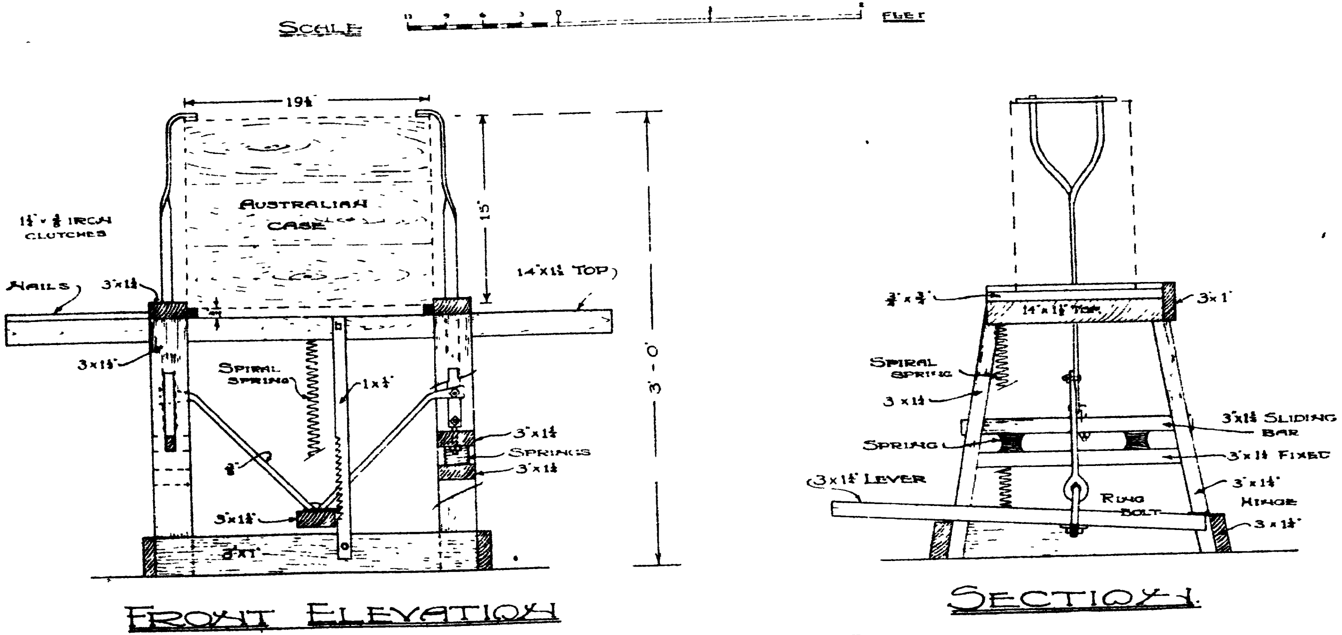


Fig. 4.—Working Drawings of a Fruit Case Press.

Nailing Presses. (Figs. 3, 4, and 5).

Three nailing presses are illustrated in the accompanying designs. The first (Fig. 3) is on the same principle as that used at Glen Innes Experiment Farm, and has proved very satisfactory. The original was built rather too light, and the design shows a heavier build. As many of the cases are now made up with end cleats, and also as the thickness of the ends varies and the overall length of the case is increased thereby, it would be advisable to allow for an overall length of 20½ inches in lieu of the 19½ inches shown

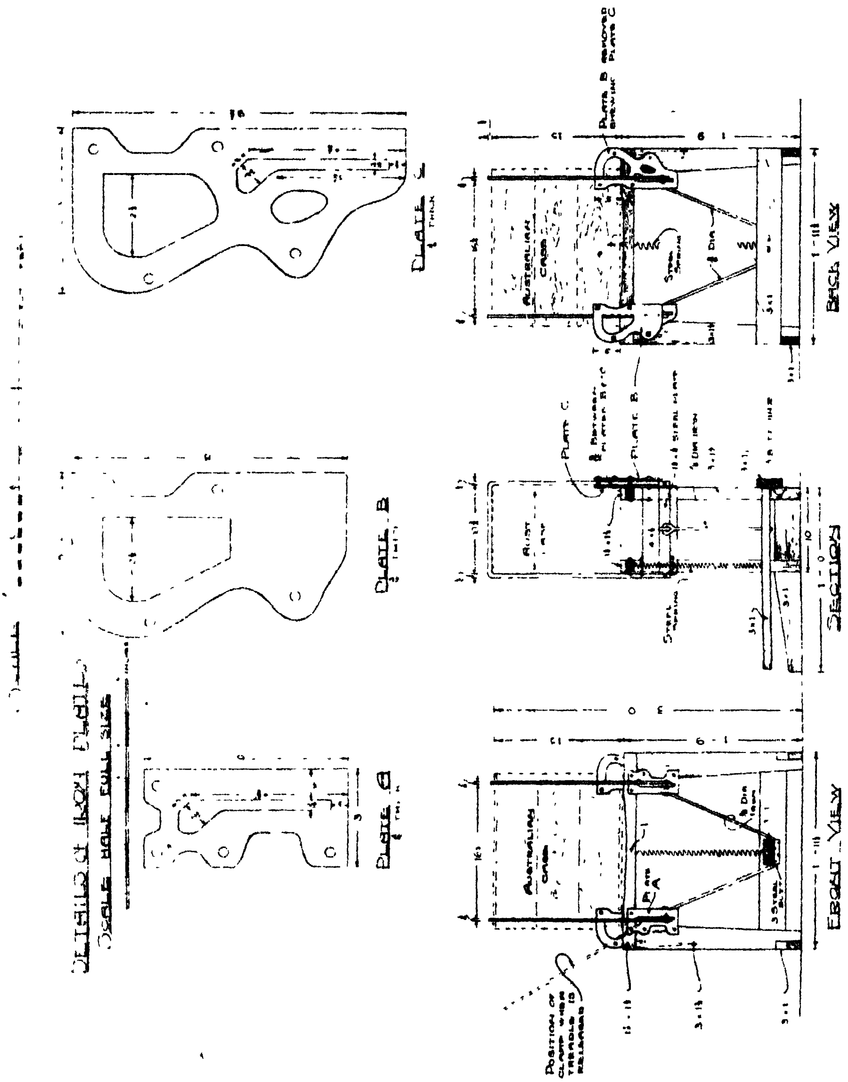


Fig. 5.—Working Drawings of a Case-nailing Press.

in the drawing if a press is being constructed to take the Australian bushel case, or of 22½ inches in the case of a press that is to take the Canadian bushel case. The blocks supporting the case should be 18 inches apart (inside edge to inside edge) for the Australian bushel case, and 20 inches apart for the Canadian bushel case.

This press can be constructed so that it will take either the Australian or the Canadian bushel case. When this is done the shorter Australian case does not set on the cross pieces as shown in the drawing, but between them, and as the table top of this press does not extend across the centre there is ample room for the bottom of the case to spring or bulge. The ends of the longer Canadian case (which is also shallower) rest on the cross pieces. A notch has then to be cut part way through each of the cross pieces, to allow the clamps to come in far enough for the Australian case. To allow for the shallower Canadian case the clamps can be lowered on the bars when nailing this type of case, but it is simpler to put in a frame to raise the case sufficiently.

Fig. 6.—Nailing Down without a Press.

The drawback to this press is that its lever arrangement is rather complicated, but this is overcome in the second design, which is a press of similar type.

The second design for a press (Fig. 4) was taken from Bulletin No. 2 of the Canadian Department of Agriculture. It has been tried in this State and found quite satisfactory, and, as can be seen, it is far simpler to construct than the first. The remarks already made in reference to allowance for the overall length of the cases also apply here. This press could also be made adjustable for either the Australian or Canadian case, but it should be remembered that the table top extends right through, and therefore the ends of any case in it must rest on cleats of sufficient thickness to allow the bottom to spring or bulge when the lid is brought down.

The third nailing press (Fig. 5) is of the hoop type. The design is from one in use at Bathurst Experiment Farm, but there are one or two defects in it that could be corrected when constructing others.

In the first place, the length of the hoops should be increased by 1 inch so as to give more clearance when being brought into position over the lid. The allowance made for the spring or bulge of the bottom as the lid is brought down should be increased to at least ¾-inch, and should be extended further towards each end to allow for the spring or bulge to start from the end of the case. This could most simply be done by placing a narrow ½-inch cross piece, so that the ends of the case only will rest on them. The hoops would then have to be correspondingly increased in length by half an inch.

Provision for the bottom of the case to spring simultaneously and equally with the lid is a most important feature in any design of press. The illustration (Fig. 6) shows how this provision can be made when nailing without a press.

TESTING A SPRAY AT HAWKESBURY AGRICULTURAL COLLEGE.

THE following spray, adopted by several members of the Middle Dural branch of the Agricultural Bureau as an effective treatment for red scale and wax scale, was recently tested by the Department of Agriculture at the Hawkesbury Agricultural College orchard:—Red oil, 1 gallon; washing soda, 20 lb.; water, 40 gallons. The test was carried out partly in order to ascertain if the quantity of soda (2 lb. more than in a spray which a member of the Bureau had reported to give a perfect kill) was excessive.

The application was made on 10th February, 1922, one Late Valencia orange tree and one Satsuma mandarin (a particularly bad tree for scale insects) being chosen for the purpose. Red and wax scale were present on the trees, and the spray did good work in cleansing them, especially the orange tree. It also blemished some of the fruit on both trees, however, and caused some of the leaves to drop—to a quite noticeable extent compared with some of the unsprayed trees. The Orchardist comments: "No doubt this is an effective spray for scale insects, and does the work needed, but I still venture the opinion that the soda could be reduced and the desired results be obtained."

With the exception of the scalding of an odd leaf, no damage resulted from the use of this spray at Yanco Experiment Farm on orange and olive trees. Scale on the olives (the citrus trees were not affected) was killed fairly well.—W. J. ALLEN.

Pure Seed.

GROWERS RECOMMENDED BY THE DEPARTMENT

THE Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Potatoes:—

Carman, No. 1	Alf. Piper, Llangothlin.
	O. E. Silk, Nimitybelle.
Coronation	J. W. Jay, Ben Lomond.
Early Manhattan	B. C. Meek, Hobby's Yards.
Early Manistee	Alf. Piper, Llangothlin.
Early Rose	W. E. Franklin, Lammer Moor, Oberon.
Factor	J. W. Jay, Ben Lomond.
	J. Piper, jun., Llangothlin.
	K. Bowen, Newport P.O., Orange.
	O. E. Silk, Nimitybelle.
Langworthy	K. Bowen, Newport P.O., Orange.
Satisfaction	W. E. Franklin, Lammer Moor, Oberon.
	O. E. Silk, Nimitybelle.
Surprise	Alf. Piper, Llangothlin.
*Symington	H. F. White, "Bald Blair," Guyra.
†Teesdale	B. C. Meek, Hobby's Yards.

Maize:—

Boone County White	J. Chittick, Kangaroo Valley.
Cocke's Prolific	Manager, Experiment Farm, Lismore.
Craig Mitchell	W. D. K. Humphries, Muswellbrook.
Fitzroy	Manager, Experiment Farm, Grafton.
	D. J. Dorward, Tayfield, Cundletown.
	J. P. Mooney, Taree.
Golden Glow	J. F. Chick, Tenterfield
Golden Superb	W. H. McMahon, Pola Creek, via Kempsey.
Iowa Silvermine	J. H. Kerr, Little Valley, Elsmore, via Inverell.
Large Red Hogan	Principal, H. A. College, Richmond.
	G. E. Levick, Taree Estate, Taree.
Leaming	Manager, Experiment Farm, Grafton.
Manning Silvermine	R. Dyball, jnr., Taree Estate, Taree.
North Western Dent	J. S. Whan, Llangothlin.
Wellingrove	Manager, Experiment Farm, Glen Innes.

Lucerne:—

Lucerne	R. J. Crosthwaite, Pilca Butta, Leadville.

NOTES:—*Symington variety has about the same characteristics as to yield and size of potatoes as Surprise, and is otherwise similar, except that it shows a variation in the colour of the skin to Surprise.

†Teesdale variety is only cultivated in a small district, in which fairly good results have been obtained during the past few years. It is a white-skinned tuber, with pink blotched eyes.

Sorghums :—	
Milo	Manager, Experiment Farm, Cowra.
Manchu Kaoliang	Manager, Experiment Farm, Bathurst.
Saccaline	Manager, Experiment Farm, Lismore.
Grasses : —	
Paspalum Dilatatum	Manager, Experiment Farm, Wollongbar.
Gramma :—	
American Pear	R. Dyball, jun., Flettwood Bag, Taree.
Peanuts :—	
Chinese	Manager, Experiment Farm, Grafton.
Valencia..	Manager, Experiment Farm, Grafton.
White Spanish	Manager, Experiment Farm, Grafton.
Pop Corn :—	
Black Beauty	Manager, Experiment Farm, Bathurst.
Sudan Grass :—	
Sudan Grass	Manager, Experiment Farm, Cowra. Manager, Experiment Farm, Temora. Manager, Experiment Farm, Yanco.
Broom Millet :—	
Broom Millet	W. G. Chaffey and Sons, Tamworth.

"LIQUID SULPHUR."

SULPHUR is insoluble in water, very slightly soluble in alcohol, chloroform, and ether; but dissolves readily in carbon bisulphide, chloride of sulphur, light petroleum, turpentine, benzol, and toluene.

It is improbable that sulphur in solution in any of the above solvents would find a use in agricultural practice. Some time ago a product termed "liquid sulphur" was placed on the market; it was chemically sodium sulphide, and it was claimed for it that when diluted and sprayed on the ground it materially benefited orchards so treated Several experiments were carried out by persons interested, untreated portions being left as controls. As a result, it was stated that the difference between the treated and untreated areas was most marked, and remained so in the second year. The practice did not meet with general acceptance, however, and has not been revived, nor, so far as is known, was the manufacture of "liquid sulphur" continued. The underlying idea of the treatment was to kill harmful micro-organisms (and some of the benign ones) in the upper layers of the soil, and so to produce a clean medium in which beneficial nitrifying organisms could rapidly increase

Ordinary home-made lime-sulphur solution contains about 8½ per cent. "sulphur" in solution out of the 18 per cent. of total sulphur present; and if a trial of soil treatment with a dissolved sulphur were contemplated, there appears no reason why lime-sulphur should not be used, especially as no other form of "liquid sulphur" is available.—A. A. RAMSAY, Principal Assistant Chemist.

Poultry Notes.

JULY.

JAMES HADLINGTON, Poultry Expert.

LAST month's notes were devoted principally to the hatching season then commencing and incidentally poultry-farmers were advised not to overdo the hatching part because too many chickens usually resulted in congestion of the brooding equipment, and sometimes over-taxed the farmer himself. It will be well to keep these facts well in mind while the season is yet young.

Ask the average poultry-farmer how many chickens he intends to rear this season, and in nine cases out of ten the reply will be to the effect that it is intended to hatch as many as he can. But unless ample provision for brooding has been made ahead of requirements, such a policy is courting failure.

Requirements in Brooding.

In respect of rearing chickens, it will be profitable and informative for the average poultry farmer to be told what brooding accommodation is required to put through a given number of chickens in the season, say, July to September inclusive, under good commercial poultry-farming conditions, in order to avoid undue losses in rearing. In doing so we have to take into consideration the different classes of brooders in use.

First, let us take the hot water circulating brooder system, with its units each having a capacity for 100 chicks of up to, say, a week or ten days old. Each unit should measure 4 feet x 2 feet, thus containing 8 square feet of floor space. It should be understood that the chickens in these units have to be thinned, first to seventy-five, and later to fifty, or even forty, as the chickens grow in size by the end of the fifth week, and that at six or seven weeks old they are transferred to the rearing pens. To carry out this plan necessitates an installation of eight brooders to put through 1,000 chickens. That number, after allowing for cockerels and losses, would be expected to insure 400 pullets.

The same would apply to lamp brooders of the same capacity, but it might be mentioned that but few makes of lamp brooders have anything like that space, in which case fewer chickens should be brooded in them.

While on these systems of brooding, it might be well to remind operators of two common mistakes seen in brooding chickens:—

(1) That lamps or other heaters are often put out during the day time. This is a mistake which often leads to trouble, in so much as the brooders cool down, and in the event of a cold change in the afternoon it often happens that the brooder units are not sufficiently warm to meet the requirements of very young chickens when evening comes. Chills are often sustained in this way, but the result may not perhaps be noted by the operator until a day or two has elapsed, and then the fact of the lamps or heater having

been out is not connected mentally with the trouble that is seen to be among the chickens. The usual thing in such circumstances is to put the trouble down to some disease. The wrong trail is struck, confusion of thought occurs, and almost everything but the true cause of the trouble is blamed for the occurrence. It is safe to say that 95 per cent. of chicken troubles are due to faulty brooding in such respects, rather than to the presence of disease as a first cause, although disease might, and often does, follow upon such faulty brooding.

(2) It has been pointed out in these notes that errors in taking the temperature are also responsible for much trouble in brooding. For instance, it is quite a common occurrence to find the temperature of the empty brooder unit much below what is necessary for the particular age of the chickens that are being brooded at the time. The point in this connection is that whatever degree of temperature is required it should be maintained day and night, whether the brooder is empty or full; otherwise the chicken is deprived of the necessary warmth that should be available to it at all times. It might be mentioned that there is available from the Department a leaflet entitled "Rearing and Feeding," which gives details regarding both, together with the temperatures that should be maintained throughout the period during which the chickens are kept under artificial warmth. These are applicable to both lamp and hot water brooders. Poultry farmers who have not had a copy of this publication can secure one (also one on "A Hot Water Circulating System of Heating Brooders") by writing to the Under Secretary and Director of Agriculture, Sydney.

The Colony Brooder.

The colony brooder is still in use on many farms and must be reckoned with as a factor in brooding, but very much of the success or non-success attendant on this class of brooding depends on the operator. It is here that the intense chicken-hunger to which I referred in last month's notes finds full expression, because the system lends itself to large numbers, even if it does not always rear them.

If the farmer who goes in for this class of brooder could only restrain his eagerness for quantity and run them with less than half the numbers usually attempted, much better success in rearing would be attained, and infinitely better chickens would be reared. Where large batches of chickens are run together in one unit, good physique is not to be expected. No matter what opinion may be entertained, there is no escape from the fact that good rearing is the foundation of all success on a poultry farm. Labour-saving devices in rearing chickens, as in any other pursuit, are to be commended up to the point where efficiency is maintained, but they become a drawback and a curse to the industry when carried to a point that results in anything less than the best development obtainable, because of the lowering of the standard of physique necessary to the highest results in production. The greatest trouble, then, with this, as with most classes of brooders, is not so much the system in itself as the way it is operated, and, speaking generally, a better recognition of the limitations of the system would lead to improved results.

The biggest indictment against the system is that it leads to the brooding of too many chickens as one unit. One of the troubles complained of by users of this class of brooder is floor draughts, but close observation will at once show that these draughts are due to the "pull" of the fire, and since that is situated in the centre of the group of chickens surrounding it under the hover, it is difficult, if not impossible quite, to overcome it. The draught must pass over the chickens to feed the fire. Hence various contrivances to overcome the trouble.

Another feature that is worth noting is that in large aggregations of chickens, such as those mentioned, it is inevitable that there shall be a deep ring of chickens around the source of warmth, with the result that the inner ones become too hot, whilst those on the outer edge of the ring are perhaps too cold. The result is that the outer ring, in an effort to get more warmth, presses the inner portion into a zone that is too hot. The outcome of this is a burst-up of the circle and a stampede, and the operator, if he visits the brooder house during the dark hours of early morning will find the chickens huddled in small groups, perhaps a considerable distance from the source of warmth. If, as is usual, the operator does not visit his brooder-house until daylight, he is quite oblivious of what has taken place. Such conditions cannot be conducive to successful rearing.

Cold versus Heated Brooders.

It might be taken as an axiom that a good class of cold brooder is better than a bad class of lamp-heated brooder, for many of the latter fail utterly to generate sufficient heat. Such a brooder becomes a snare and a pitfall to the chicken rearer. If heat is to be used at all there must be an abundance of it, or trouble will ensue. Not only so, but the chickens must not be removed from such warmth until they are nicely feathered, or, say, about six to seven weeks' old. One frequently sees chickens taken from a heated brooder at three weeks' old. The result of this practice is usually to stunt the growth of the chickens, if, indeed, nothing worse happens as a result of their crowding together for warmth. A commercial poultry-farmer cannot afford to take such risks.

It might be asked, what about the chickens brooded in cold brooders, do they not crowd? The reply is, "Not if the cold brooder is properly constructed." In the latter the chickens are dependent upon the conservation of their own bodily warmth, and in the cold brooder this is usually achieved by (*a*) strips of flannel placed at regular and close intervals under a hover, so that the chickens nestle against them to retain the warmth, or (*b*) the roof of the hover is so arranged as to fall down in the centre sufficiently low to touch the back of the chickens when they seek warmth.

Then, again, an essential feature is good ventilation without exposing the chickens to draughts, or the warmth generated by their bodies will be dissipated.

Another essential is that the chickens require very careful attention to teach them to use the unheated brooder. In a heated one the warmth attracts them. In one of the latest patterns put on the market this feature has been attended to, and there is an arrangement in the form of a miniature fence which is designed to keep the chickens close to the brooder until they have learnt to use it. This is certainly a big advance on some old methods.

However, cold-brooding is not to be regarded as equal to warm brooding where conditions of the latter are as they should be, and more labour and a good knowledge of rearing chickens is essential to success with cold brooding.

TO POPULARISE HONEY.

EVERY effort should be made by all interested in the honey business to stimulate the sale of the commodity, for there are still fairly heavy stocks on hand, and although honey can be kept for long periods without fear of deterioration, it is to the advantage of all concerned—providing, of course, a reasonable price can be obtained for it—that a good deal of the surplus be disposed of before the new season's crop comes. Something has already been said in this journal with reference to improving the honey market by co-operation and the decentralisation of supplies, and in the past few months there has been some improvement in the matters of distribution and sales. The appointment of three practical apiarists as an advisory board to look after the bee-keepers' interests in co-operative marketing was one step in the right direction, and the co-operative retail marketing movement in which the New South Wales' Apiarists' Association is now interesting itself, is another. There is still a good deal to be done, however, before marketing conditions will be on anything like a satisfactory basis. The bee-farmer's interest in marketing should not cease when his individual crop is disposed of. Every effort should be made to induce distributing agents and storekeepers who have honey for sale to have the commodity exhibited in a position in which it will come well under the notice of possible customers. It is quite a common practice for such agents and storekeepers to place honey on shelves set so low as to be practically out of sight, and to give it the poorest sort of window display. Where space is limited, some sort of attractive display notice should be supplied and the retailer encouraged to make use of it. Again, those interested in the industry should never neglect an opportunity of inducing friends and acquaintances generally to use honey in their homes, or of bringing to the notice of boarding-house keepers, hotel proprietors, and persons interested in the conduct of large institutions the value of honey as a food. Honey is a good food and a cheap one, and it is very much to the bee-keeper's interest that it should find a place on the lowliest table.

With regard to honey prices, the fact that there are among the ranks of bee-keepers a good many amateurs and bee-keepers in a small way, is apt to constitute something of a menace. Some of these dispose of their crop at a ridiculously low price to the disadvantage of the commercial man who depends on his returns for a living, for naturally the people who purchase at the low price do not afterwards care to pay a high one to the commercial bee-farmer, even though it be a fair one. Both the bee-keeper making the low-priced sales and the industry at large would benefit greatly, if trouble were taken to discover the fair market value for the produce.—W. A. GOODACRE, Senior Apiary Inspector.

Orchard Notes.

JULY.

W. J. ALLEN and W. LE GAY BRERETON.

LAST month attention was drawn to the necessity, where orchards were carrying either a sown or a weed crop, of completing the winter ploughing not later than the end of July. It might be added that this also applies where the ground has become set, even if it is carrying practically no weed growth.

In inland districts with limited rainfall, and where irrigation is not available, this is specially necessary; for, if provision be not made to catch and store as much of the winter rain as possible, little success can be expected in the ensuing season. Even in districts of more ample rainfall abnormally dry periods are liable to occur, and it is wise to be prepared by carrying out such ploughing early.

An exception can be made where an orchard has received an autumn ploughing and where the land has not again become set, or on which weeds have grown to any extent, and which consequently is in fit condition to catch and hold any rains that fall. In such cases ploughing could be advantageously delayed till more of the other winter work, and its consequent tramping of the soil, is through.

Pruning.

In some districts apples and pears have carried their foliage late this season, and, though it is not likely that pruning while this foliage is still hanging would be detrimental, still it hampers the work, especially in dealing with the more detailed work of the fruit spurs. By this time, however, these trees will be bare of foliage.

Instances are met with where, though the building of the framework of the tree has been well carried out and maintained, no attention is given to the fruiting wood, and provision is not made for renewal of spent wood. It should be borne in mind that though the fruiting spur of the apple and pear is more or less self-replacing, and consequently there is not the need for the annual renewal of fruiting wood as in the peach, still the apple and pear spur gradually does lose its vitality. This will be noticed especially in those nearest the base of the laterals, and if attention is not given in time it will be found that the cropping is creeping more towards the terminals of the laterals. Again, in some varieties the spurs multiply very fast, and if not thinned out will, by becoming too thick, weaken one another to such an extent as to fail to set fruit. This is especially true of Winter Nelis pear; this variety for some time proved a shy cropper in the orchard at Bathurst Experiment Farm, but the present orchardist has for some years shown that by severe thinning of the spurs this variety is a consistent cropper there. Moreover, it has been shown that this treatment of the spurs holds good in some other districts where it has been tried. In trees where this treatment of the spurs has been neglected care will have to be exercised the first season it is put into practice to leave sufficient well developed, plump spurs.

While pruning is in progress scions can be secured for any grafting that is to be carried out in the spring. Such scions should only be taken from trees that have been giving consistent crops of a good type of fruit. The scions can be kept in bundles in moist sand in a cool place. If more than one variety is stored they are better tied with thin wire, and each bundle should be labelled with a wooden or zinc label. The marking should be done by smearing the label with thick white paint, and then, while wet, writing the name with a broad lead pencil, If care be not taken in this way there is a risk of the different varieties becoming mixed while in store.

Other Winter Work.

July is a good time to make the application of lime-sulphur for leaf curl of peach and nectarine. Recent experiments indicate that lime-sulphur, weaker than winter strength, will control leaf curl, but these experiments will have to be carried further before the weaker strength can be relied upon, and the full winter strength is still recommended for the control of this disease. It is essential that the application be thorough, and that the ends of the lateral growths shall not be missed.

Bordeaux mixture can be used instead of lime-sulphur for the control of this disease, but either spray should be applied while the trees are dormant.

Where codlin moth has been troublesome, it is a good practice to examine any crevices or loose bark on the trunk and limbs forming the framework of the tree, and to kill any codlin larvæ that are sheltering there before they change into the moth form and start egg-laying.

The same remarks apply to the bandages that have been left to trap any larvæ that are driven from less snug hiding places by the winter rains and cold.

Where artificial fertilisers are being used they can be applied and ploughed in during the winter ploughing.

A BOOK ON PRUNING.

THE orchardist and the home gardener with a few fruit trees will find any reliable book on pruning of interest just now. "Pruning," by W. J. Allen, Fruit Expert, comprises just on two hundred pages of copiously illustrated matter concerning the subject. The price of "Pruning" is now 3s. 3d., post free. It is obtainable from the Government Printer, Phillip-street, Sydney, and from most metropolitan booksellers.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1922.

Society.	Secretary.	Date.
Hay P. and A. Association (Sheep Show)	C. L. Lincolne	July 12
Wentworth, P. A. and I. Society	W. B. Crang	,, 19
Parkes P. A. and H. Association	J. Heel	Aug. 15, 16
Forbes P. A. and H. Association	E. A. Austen	,, 21, 22, 23
Murrumbidgee P. and A. Association (Wagga)	A. F. D. White	,, 22, 23, 24
Corowa P. A. and H. Society	J. D. Fraser	,, 29, 30
Grenfell P. A. and H. Association	G. Cousins	,, 29, 30
Gunnedah P. A. and H. Association	M. C. Tweedie	,, 29, 30, 31
Yanco A. Society (Leeton), (Spring Show)	W. M. Evans	Sept. 2
Junee P. A. and I. Association	T. C. Humphreys	,, 5, 6
Young P. and A. Association	T. A. Tester	,, 5, 6, 7
Northern A. Association (Singleton)	J. T. McMahon	,, 7, 8, 9
Hills District Fruitgrowers' Association (Galston)	B. F. Renant	,, 8, 9
Cootamundra A. P. H. and I. Association	Wm. A. Sowter	,, 12, 13
Cowra P. A. and H. Association	E. P. Todhunter	,, 12, 13
Ganmain A. and P. Association	A. R. Lhuede	,, 12, 13
Albury and Border A. and H. Society	A. G. Young	,, 12, 13, 14
Holbrook P. A. and H. Society	Jas. S. Stewart	,, 19, 20
Temora P. A. H. and I. Association	A. D. Ness	,, 19, 20, 21
Burrowa P. A. and H. Association (Boorowa)	W. Burns	,, 21, 22
Murrumburrah P. A. and I. Association	W. Worner	,, 26, 27
Henty P. and A. Society	H. Wehrman	,, 26, 27
Narrandera P. and A. Association	W. H. Canton	,, 26, 27
Condobolin P. A. H. and I. Association	H. Monro	Oct. 3, 4
Hay P. and A. Association	C. L. Lincolne	,, 4, 5
Berrigan A. and H. Society	R. Wardrop	,, 10
Tweed River A. Society (Murwillumbah)	T. M. Kennedy	Nov. 22, 23

1923.

Society.	Secretary.	Date.
Kiama Agricultural Society	G. A. Somerville	Jan. 25, 26
West Bargo A. H. and I. Society	L. J. C. Hicks	,, 26
Yanco A. Society (Leeton)	W. M. Evans	Feb. 13, 14
Shoalhaven A. and H. Association	H. Rauch	,, 14, 15
Guyra P. A. and H. Association	P. N. Stevenson	,, 20, 21, 22
Nepean District A. H. and I. Society (Penrith)	C. H. Fulton	,, 22, 23, 24
Newcastle A. H. and I. Association	E. J. Dann	,, 27, 28, Mar. 1, 2, 3
Central New England P. & A. Assoc. (Glen Innes)	Geo. A. Priest	Mar. 6, 7, 8
Hunter River A. and H. Assoc. (West Maitland)	J. S. Hoskins	,, 7, 8, 9, 10
Berrima A. H. and I. Society	W. Holt	,, 8, 9, 10
Campbelltown A. Society	J. T. Deane	,, 9, 10
Camden A. H. and I. Society	G. V. Sidman	,, 16, 17
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins	,, 21, 22

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Agricultural Gazette of New South Wales.

The Cotton Crop.

CULTURAL ADVICE FOR NEW SOUTH WALES.

A. H. E. McDONALD, Chief Inspector of Agriculture.

COTTON has been grown in Australia for many years, but as an industry it has had several ups and downs. As long ago as 1845, Dr. Lang, while visiting Moreton Bay (then part of New South Wales, but included in Queensland when that State was established), formed the opinion that many of the British residents, who were then living in poverty and hardship, might make comfortable livings growing cotton. He was able to induce a fairly large number of people to settle on the land and to take up the crop, and some cotton of good quality was produced, but the venture was not a success, and cotton-growing languished until the time of the American civil war.

During that struggle the cotton-spinners in England found great difficulty in obtaining supplies from their usual sources (the Southern States), and the high prices that were offering revived interest in the crop in Queensland, and for five years a comparatively large area, running up to 14,400 acres, was sown. The restoration of peace in America and the return to normal production, together with difficulties in regard to communication, caused the crop again to become unpopular in Queensland.

On two occasions in later years mild interest was again created in the crop by manufacture being undertaken at Ipswich, but the crop was grown only to a very limited extent. In the years immediately prior to the European war the Queensland Government took steps to encourage the crop, and in 1913 offered an advance of 1½d. per lb. The ultimate return to growers in that year was 1¾d. per lb for seed cotton.

In New South Wales cotton has never at any time been extensively grown. The Department of Agriculture has for a number of years planted experimental plots on one and another of the farms, and has also distributed seed to farmers, but the culture of the crop has never been taken seriously—probably because of the good returns that have always been obtainable from dairying and from maize-growing. In the districts most suitable for cotton the climatic and soil conditions are particularly favourable for dairying, and what land farmers can put under cultivation has usually been laid down in maize, a crop that has the dual recommendation that if the season happens to be dry, and the maize fails for grain, the pastures are also poor, and then maize stalks give a good return by serving to keep up the milk flow.

Cotton-producing Countries..

The United States of America is the chief cotton-producing country of the world, about 13,000,000 bales of 500 lb. each being produced there in 1920, and about 8,000,000 in 1921. Other important producing countries are China (about 4,000,000 bales), India (about 3,500,000), Egypt (650,000), Africa, excluding Egypt (50,000), Russia (about 900,000), Mexico (150,000), Brazil (600,000), and Peru (150,000). Various other countries, such as Japan, Korea, Greece, Nyassaland, and Hayti, produce smaller quantities. It is expected that the yield in Queensland this year will be about 2,000 bales. Practically no cotton is grown in the other States of the Commonwealth.

Suitable and Unsuitable Soils.

Cotton will thrive on a fairly wide range of soils, though it will not produce profitable yields on poor, hungry land, and its growth should not be attempted on land that is not capable of producing at least 40 bushels of maize per acre under average conditions. Where the soil is poor the yield is light, the staple short, and the cotton of little value. The best soils are the rich, friable, alluvial soils of the North Coast rivers. Fairly good crops may also be produced on some of the higher land.

Cotton is a plant which thrives under warm conditions. In cold, wet soils the growth is retarded. The drainage should therefore be good. On the other hand, a regular supply of moisture is essential, and soils which dry out rapidly are not suitable.

Climate.

Cotton can only be successfully grown in warm climates with a good rainfall, and with a summer season of about seven months between frost. The crop requires a fairly good and evenly distributed rainfall. The ideal conditions are warm days and nights, with a good rainfall up till about January, followed by fairly dry, bright weather in the succeeding months, when the cotton is ripening. Heavy rains during the ripening period interfere with the picking, and also cause deterioration in the quality of the cotton. Where the rain is excessively heavy, particularly from January to May, the cotton cannot be successfully grown.

In this State the climatic conditions are most favourable on the North Coast. Cotton cannot be successfully grown on the tablelands nor the western slopes in close proximity to the tablelands.

In the north-west the conditions in regard to heat are suitable and in seasons when the summer rainfall is fairly good cotton thrives, but the rainfall is too uncertain for the crop to be successfully cultivated as a general practice. In the western and southern districts the rainfall is altogether too light during the summer. On the Murrumbidgee Irrigation Areas cotton gives good yields where the soil is suitable.

The Preparation of the Land.

It is necessary to give careful attention to the preparation of the land. An early and deep ploughing should be given; the time depends, partly, of course, upon when the preceding crop is taken off, but arrangements should be so made, if at all possible, that the first ploughing should be given not later than June. The land should be allowed to lie in the rough through the winter, and about the end of August a cross-ploughing may be given. As planting takes place about the end of September, it will probably be necessary to plough again in order to put the land into a good, friable condition for the sowing. This spring ploughing should be only about 4 inches deep. The surface soil has been sweetened and improved in fertility by the weathering during the winter, and if the ploughing is too deep the sweet soil will be buried and inferior soil brought to the surface. As the best conditions must be provided for the germination of the seed and the feeding of the young seedlings, the richer and more friable surface soil should therefore be retained on the top and merely given a shallow turning.

The soil should be in a fine, firm condition, and the harrow and roller should be used to ensure that it is so. Thorough early cultivation leads to the decay of trash, such as maize stalks, &c., improves the fertility of the land, and tends to ensure a vigorous growth of the crop, while at the same time conserving any moisture that may fall before sowing, thus making it available to augment any rain that may fall during the growth of the crop.

A great deal of labour and time is involved in the picking of the cotton crop, and this is very considerably reduced if the plants are large and vigorous and carry a good number of large bolls. On the other hand, much time is lost if the plants are small and poor, with few bolls. Hence the cultivation, which is comparatively inexpensive, should be done carefully with a view, not only to producing a heavy crop, but also of reducing the expense of gathering the cotton.

Sowing the Seed.

Cotton seed is somewhat shy in germinating, and therefore a fairly liberal seeding is required. Many growers sow only 10 to 12 lb. per acre, but more satisfactory results are obtained with 15 to 20 lb. A thin stand is unsatisfactory, as it leads to a woody or vegetative growth rather than to good cotton-bearing plants. A thin stand cannot be subsequently remedied, but it is a simple matter to thin out the plants where the stand is too thick. In cotton-growing countries thinning is recognised as an essential cultural operation.

The seed carries short fluff, and requires treatment to facilitate sowing when machines are used, but if dropped by hand the fluff is not so objectionable. Various methods of removing the fluff are adopted. We have found that rubbing the seed in clean, sharp sand is effective. In Queensland, growers obtain a dry, hollow log which is fired inside and then placed in an upright position over a tub of water. The seed is dropped through the fire into the water. Another method is to dip the seed in a thin paste made of clay or flour, and then dry it; but care must be taken that the seeds do not stick together while drying.

The seed is dropped in rows, about 4 ft. apart in the richer soil, and about 3 ft. 6 in. apart where the soil is of a lighter character. Where weeds are likely to come thickly the wider space is desirable, as it gives better opportunities for the destruction of weed growth by cultivation. It should be planted on the flat, and must not be covered more than 1 to 2 inches deep. The seed should be sown in moist, firm soil to ensure prompt germination.

The ordinary maize-dropper is most suitable for planting, as it can be adjusted to plant the seed at the right depth, and to firm the soil around the seed to the right extent to promote germination. Where the surface soil is dry or cloddy a furrow-opener should be attached to the front of the drill to open up the moist soil to receive the seed. This furrow should be deep enough to push away the clods and dry surface soil. The plate supplied for the sowing of maize for silage purposes is very suitable for the sowing of cotton seed.

Varieties.

Seed of only one variety is available in quantity at the present time. This is an Upland variety which is grown largely in Queensland.

The New South Wales Department introduced a number of the best varieties from the United States of America some time ago, but none of the seed is yet available for distribution, as it is being grown to obtain larger supplies of seed on the experiment farms of the Department. Among these is Pima, an Egyptian-American variety. It produces a long, fine-stapled lint, and is therefore more valuable than the usual Upland type.

Perennial Cotton.

From time to time reports are circulated of perennial types of cotton, and of cotton plants being carried over into the next season, thus avoiding re-sowing. Perennial types exist, but the quality of the cotton is inferior and not popular with spinners.

It is claimed by some growers in Queensland that the cotton plants may be pruned at the end of the first year, and that they will then give a good crop in the next year. Such a system is not suitable for New South Wales conditions, owing to the plants being cut down by frost, to the growth of weeds, and to the setting together of the land. The crop must therefore continue to be grown annually.

Fertilisers.

Cotton gives its best yields on soil that is well supplied with the substances which usually form plant-food. No exact information is available in regard to just what fertiliser will give the best results, but experiments with a number of other crops indicate that a mixture of equal parts of superphosphate and bonedust is most suitable. While the nitrogen content of many of our soils is not high, the climatic conditions in those districts where cotton can be grown are particularly favourable to nitrification, and therefore sufficient nitrogen in an available form can be relied upon without recourse to artificial fertilisers. It has not yet been found that potash needs to be supplied to crops on the North Coast, but phosphoric acid is deficient, and is supplied by the above mixture, partly in an immediately available form in the superphosphate, and partly in a form which becomes available to the plant at the later stages in the bonedust. The combined fertiliser therefore feeds the cotton regularly throughout its life.

On the medium soils 2 cwt. per acre should be applied, but on the better-class land 1 cwt. will be sufficient. The fertilisers should be sown at the same time as the seed. Most maize-droppers are provided with a fertiliser distributor, but if no machine is available the fertilisers may be broadcasted.

Cultivation.

When the soil conditions are favourable in regard to warmth and moisture, germination occurs immediately, and the plants appear in a few days. As soon as the young plants are well above the ground, cultivation should be commenced. It loosens up the soil and destroys the sprouting weeds. The first cultivation should be light, and generally a light tine cultivator or harrows will do all the stirring that is needed. It is most important that this cultivation should be given as early as possible, and that it be repeated as frequently as necessary. At this stage the cotton plants are not vigorous enough to outgrow the weeds, and furthermore it is necessary to destroy the weeds before they are well rooted. Cotton is somewhat shallow-rooted, and if the weeds are allowed to make much headway deep cultivation will be necessary to dislodge them, and by cutting and tearing the cotton roots, this deep working will be somewhat harmful. In the later cultivation disc or tine cultivators may be used, according to circumstances. The aim all the time should be to keep the soil in a fine, loose condition on the surface to retain the moisture and destroy weeds, and to avoid going so deep that the roots be broken.

Thinning.

This process in cotton-growing countries is known as "chopping," and is essential to the ultimate success of the crop. As already indicated, the seeding must be heavy to insure a good stand, but this results in many plants coming close together, and, to give each plant sufficient room to develop satisfactorily, thinning is necessary. Failure to thin results in many of the plants being spindly and unthrifty. The operation should be delayed until the plants are about 9 inches high, and they should be thinned to about 9 inches apart. Leaving the thinning until this stage makes it possible to select the strongest plants, and also tends to check what are called the vegetative branches (those that bear few bolls), and to cause the plants to produce chiefly fruiting branches. Some growers thin to 12 to 15 inches apart, but it is considered that by leaving the plants closer together as good a yield, if not better, is obtained and picking is carried out more easily.

Thinning can be done with the hoe, but hand-pulling is more satisfactory, as the weakest plants can then be pulled, and the strong, vigorous plants preserved, a more regular stand being obtained than is possible when the plants are "chopped."

Cotton Under Irrigation.

Cotton can be grown successfully on the Murrumbidgee Irrigation Areas on the light loamy soils, but not successfully on the heavy soils, chiefly owing to the difficulty of securing a satisfactory germination. The details given above in regard to culture apply largely to cotton grown under irrigation also. The land should be well graded, and should be flooded, and then cultivated to a fine condition for sowing. While the cultivation of cotton grown without irrigation may be largely on the flat, in the case of irrigated cotton, after the first cultivation the earth should be gradually worked towards the plants, to form a central furrow for the water and to support the plants.

Pests.

A number of insects do some damage to the cotton in this State.

Occasionally *cutworms* attack the young seedlings, cutting them off below the surface. By thick seeding any danger of loss in this way can be avoided.

In the northern districts, a green striped *Boll moth* (*Earias smaragdina*) has attacked the bolls to some extent, while on the Irrigation Area the early bolls were attacked by the *Yellow Peach Moth.* The grubs of these moths burrow into the boll and destroy the cotton.

The *Boll Weevil,* an extremely serious pest in the United States of America, has not yet been reported in this country, and very great care is being exercised in order to keep it out. It is necessary to import some varieties of cotton seed, but only small quantities are brought in, and the seed is sown in strict quarantine. If this pest is once imported it will do enormous damage; and the most stringent action must be taken to prevent it gaining a footing.

Spraying with arsenate of lead would check these pests, but it does not pay to spray cotton in large areas.

Picking.

The first flower-buds appear about forty to fifty days after planting, and it is another thirty days before the flowers are fully opened. After fertilisation the flower drops off, and the small boll commences to develop. Meantime other flowers are being produced, and will still be appearing when the first bol are ripening. The bolls increase in size until they are about

1¼ in. in length and slightly less in diameter. On maturity (towards the end of February in the case of the first bolls), the bolls burst, exposing the cotton, which is held very lightly in the open boll. It is not necessary to pick at once, and as a rule picking is not commenced until sufficient bolls are open to allow of a fair day's picking being done. The cotton bolls continue to form until the plants are cut back by frosts. Hence the plants must be picked over several times; as a rule about three pickings are made.

Many attempts have been made to devise a machine that will pick cotton, but so far nothing of a practical kind has been evolved, and picking must still be done by hand.

The cotton is, of course, very light. Where the fibre is of good length the produce of about 80 to 100 bolls will weigh 1 lb., but when the bolls are smaller from 100 to 150 bolls will be required to give 1 lb. of cotton.

The cotton should not be picked when it is wet with dew or rain, and when the mornings are dewy picking should be delayed until the sun has dried the cotton. It is also essential that the cotton be kept clean. All trash, such as dead leaves, &c., that may become attached to the cotton must be picked off before it is put into the bag. When the cotton is picked in a damp condition it must be dried by spreading it out in thin layers on a clean cloth before baling.

The different pickings should be baled separately, as there is generally a difference in the quality of each picking.

From the foregoing it will be seen that there is likely to be no difficulty about growing cotton, provided that the right district is selected, and that good farming methods are adopted, the various operations being carefully carried out as outlined above.

The limiting factor in regard to its profitable production is the labour involved in picking. Under average conditions the yield can be set down as about 600 lb. per acre, although where the soil is very fertile and the weather conditions favourable, up to 1,000 lb. or more can easily be obtained.

The amount of seed cotton which can be gathered per day depends, of course, upon the pickers. It is stated that in Queensland this year the record picking for one day was 170 lb. The work does not entail heavy labour, but it requires speed in the movement of the hands and steady application throughout the day. A fair day's picking is from 80 to 100 lb. Assuming a yield of 600 lb. per acre, the total time occupied in picking one acre would therefore be six days. If a wage of 12s. per day is allowed the picker, the cost of picking works out at approximately 1½d. per lb. As the cotton is picked from the plant it is called "seed cotton," as it still contains seed. When the seed has been removed (by the process known as ginning) it is called "lint" or cotton. About 3 lb. of seed cotton are required to produce 1 lb. of lint.

The Process of Ginning.

When the seed cotton has been gathered it is packed into bags or bales and sent to the ginning mill for the removal of the seeds. In cotton-growing countries ginning mills are located close to the cotton fields, and in Queensland, where cotton is grown to some extent, mills have been erected in central positions by the Australian Cotton Growing Association (Queensland) Limited. Such mills are in operation at Brisbane and Rockhampton.

The amount of cotton grown in New South Wales so far has been so small that the erection of mills has not been warranted. It is understood, however. that the Australian Cotton Growing Association is making arrangements for the erection of a ginning mill. The seed having been removed, the cotton is then baled and despatched to market. Most of the cotton grown in Queensland is sent to England, which offers the most favourable market.

Prices.

At present the open market price of middling cotton lint is about 13d. per lb. After allowing for the cost of ginning, freight, marketing, &c., this is equivalent to about 2¾d. or 3d. per lb. to the farmer for his seed cotton. This represents a gross return of from £7 to £12 per acre. In Queensland the Government has guaranteed growers in that State 5½d. per lb. for good quality seed cotton up till June, 1923. The Queensland Government has in turn been guaranteed 1s. 6d. per lb. for cotton lint by the British Empire Cotton Growing Association. This Association had allocated to it £1,000,000 by the British Government out of profits made in the purchase of Egyptian cotton during the war, for the purpose of encouraging the growing of cotton within the Empire. The members are principally users of cotton, and they have taxed themselves to the extent of 6d. on each bale of cotton imported to further increase their funds.

In regard to the guaranteed price granted to the Queensland Government, the New South Wales Department of Agriculture has endeavoured to obtain a similar concession, but so far its efforts have not been successful. The position, therefore, is that so far as cotton grown in New South Wales is concerned, the price ruling in the open market must be accepted, and growers must face the competition of those in countries where the industry has long been established.

Conclusion.

Growers must realise that cotton requires a fair amount of labour in the picking, and it is unwise to plant extensive areas until they satisfy themselves that they can provide this labour. It would be wise for those who have had no previous experience with the crop to confine their plantings to comparatively small areas. The uncertainty in regard to price should also be taken into consideration by intending growers. The Department of Agriculture will supply up to 5 lb. free for trial. Larger quantities can be obtained from Australian Cotton Growing Association, Limited, 92B Pitt-street Sydney, at 1d. per lb., free on rail or boat. Growers on the coast north o Grafton may obtain seed from the Australian Cotton Growing Association Limited, 318 Eagle-street, Brisbane.

Wild Oats.

C GOW, Barellan *

THE wild oat belongs to the family of grasses called *Avena*, which includes a large number of varieties of cultivated oats. The wild oat is known in every land where cereals are grown,.and at all times has been a menace and source of trouble to farmers. *Avena fatua* is the species now demanding our attention. It matures quickly, and usually sheds the bulk of its seed before the sown crop of wheat or grain is harvested, thus re-sowing its crop for the following and often for succeeding years.

Once it gets thoroughly established in a cultivation paddock its complete eradication is a matter of hard work for many years, and it requires a study of the plant's history to cope effectively with it.

The wild oat is covered with a thick velvety oily coat, which keeps out the small amount of moisture that would sprout and germinate any other variety of grain at times unfavorable to them and thus destroy them. The two things most essential to the germination of oat seed are moisture and warmth. Thus an oat buried, say, 5 or 6 inches below the surface may not germinate for years, even though heavy rains fall, should sufficient warmth of the sun be lacking at that particular period. Its twin brother, which may, perhaps, be buried an inch below the surface, would naturally receive more sun, and with the same amount of moisture would probably germinate, while a third brother, lying on the surface, may calmly wait for years until it receives just the amount of covering, moisture and warmth necessary to penetrate its oily coat.

Once oats are firmly established in the paddocks, the farmer's two best friends are sheep and cultivation. In fact, I doubt if in this country any man can be a successful farmer without sheep, as they prevent oats from seeding, and being cud-chewing animals they destroy all the oats that they eat, even if ripe. Horses will often pass them through the stomach without injuring them in any way. By cultivation I do not mean fallow alone. It is now becoming an accepted fact that fallow alone in many instances is apt to bury the oats too deeply, and perhaps to protect some of the seeds for years. For this reason many farmers are now adopting the method of cultivating or scarifying their land as soon after harvest as possible, thus lightly covering the oats and other weeds, and inducing them, as far as possible, to germinate with the first rains. Later on, the land is fallowed and all growing oats are turned down. Some may say this entails too much work, but the first cultivation is done with an implement which works up 12 or 18 acres in a day, and besides covering the oats it opens the soil, permitting it to absorb early rains, and thus making the fallowing easier and more beneficial.

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* **Paper read at the June meeting of the Barellan Branch of the Agricultural Bureau.**

Some competent authorities say that under favourable circumstances wild oats will remain in the ground from one up to ten years, and I am inclined to think this is correct. In 1907 or 1908 the road from Barellan to Leeton was widened, and some two chains were taken off an old cultivation paddock for this purpose. So far as my recollection goes no oats appeared on this road till 1916, a very wet, warm year and most favourable to wild oats germinating. In that year they grew in profusion along the line of the old cultivation on the road, showing just what land had comprised the old paddock. Prior to that the road was included in a sheep paddock so that any oats that may have grown between 1907-8 and 1916 were eaten off by the stock.

Under some circumstances they grow to a great height. Last year in our district a farmer sowed wheat on a fallow paddock which was very oaty; he had fallowed early and turned the ungerminated oats down the previous year, and when sowing his fallow it appeared to be perfection. A heavy early storm fell, which, with the autumn sun, no doubt had an effect on the oats buried far down in the ground, but being deeply covered it took some time for them to stir. A little later the farmer sowed his wheat, more rain followed, and in a few days the wheat came up. Just then a swarm of grasshoppers happened along, eating the wheat down just as the oats appeared. The latter quickly overcame the wheat, and by harvest time stood in places to a height of from 5 to 6 feet. Scarcely a head of wheat was discernible in the whole paddock of some 60 to 70 acres. Now, had this farmer the previous year lightly cultivated his paddock to germinate those oats prior to turning them down deeply in the ground, he would probably have had a moderately clean crop

Even fallow and a previous light cultivation may not start all the oats. Some will come up during the winter and spring, but sheep can deal with these if turned on the ground. Those that trouble the farmer most are the ones that do not come up during the first winter and spring after fallowing, but appear in the paddock the following year, just as he is about to sow. For this reason, if early rains fall on the fallow, it should be harrowed at once to conserve the moisture, and start as many oats as possible before seeding time. These should be carefully worked down with a disc or other implement before sowing.

Observant officers of the Agricultural Department say—and I think truly, too—that the reason why our country is becoming so oaty is because of the combined harvesters, &c., which blow the chaff out over our paddocks. With the chaff, most of the oats, which are light, are blown out and evenly distributed, only to appear later on. In other countries, particularly in Canada and the United States, machines such as ours are not used, nearly ali their harvesting being done with the reaper and binder, and the straw is mostly carted off the ground.

As a proof of the way in which oats are spread by machinery, I may mention a 40-acre section on a farm on Binya which was cleared in 1870—some 52 years ago. It was used as a hay paddock by the station, and as agricultural machinery progressed it was probably first harvested with the reap hook and scythe, later on by an old mower and back delivery, and so on till the reaper and binder came into use. The remains of the old implements are still in existence. Anyway, it was never harvested by modern harvesters, and to-day it is a cleaner paddock than many of those in this district that were not cleared so late as 1912—only ten years ago.

Wild oats in New South Wales are worst in the north-west, but it is roughly estimated that one-third of the State is affected. I do not mean we are losing one-third of our crop by oats, but I do believe that in this one-third— if we lose half our crop—and I do not think that is an over-estimate —we would, on the average price of wheat for the last two years, lose quite £1,000,000 yearly. What would we say if any Government deliberately robbed us of £1,000,000 per year, yet we are robbing ourselves, and many o us make no effort to stem the tide. I would strongly urge all farmers, first of all, to grade their seed (taking out all wild oats), keep sheep, cultivate their land first, and fallow it afterwards, and if only a few oats appear in the crop to pick them out by hand. The task is not so difficult, for they mature quickly, and mostly show up early in the crop of wheat. Where a paddock is only lightly affected, 30 to 40 acres per day can be picked by hand—in some instances more.

This district is to-day one of the cleanest in the State, but it seems to me to become dirtier every year, thus reducing the average yield and the value of the land.

Apart from cultivation, fallow, clean seed, and sheep, the best methods of being free from wild oats are to see that after fallowing no large clods are left on the surface. These often hold oats, and unless broken down by heavy rains the oats which remain in these dry clods do not sprout.

Keep as few dry trees in the paddock as possible. I know one paddock with many dry trees in it; the farmer cannot plough very close to these, and even though the rest of his crop is moderately clean, there is always a fringe of oats round these trees, and they are yearly extending away from them, and getting a hold of the paddock.

Do not at any time sow half the paddock and leave one-half out for fallow. Better put it all in. Sheep cannot be kept in the half that is left, and even though the farmer may make up his mind to work it constantly, he will find that oats will grow and seed in spite of him. If there is a good strong stubble, and a good hot burn can be got early, it will kill a large number of oats lying on the surface, though this does not always come off.

After the 1919 drought I saw a farmer sowing a crop, and having a habit of always looking at what a man is sowing, I opened the box, and found that 10 per cent. of the seed being sown was wild oats. I observed the paddock the following year, and noticed a large number of oats in the wheat; again last year, I looked, and found that, so prolific and pugnacious had these oats become, that they were now half the crop. In two years they had claimed half his land. I asked the farmer why he did not winnow his seed and take as many oats as possible out. I know he had a good winnower, but he said he had not time to do so—but he had time to lose half his crop in two years

A grader is very essential to good clean farming, it will pay for itself in from one to two years in the cracked and small grain which is of no seeding value, quite apart from taking the wild oats out. In many instances two or three farmers have banded together to keep graders, and certainly this is a step in the right direction. Failing a grader, hand pick the crop that is to be kept for seed; it will not take long to do it. In this district last year several farmers cut and stacked their wild oats for hay. This is very undesirable, indeed, for it is only building up further trouble; never use oaty hay. Apart from the fouling of the land, they are not good nutritious feed compared with other grain.

Of course, it is only fair to the wild oat to admit it has some virtues, but its very warmest friend must admit they are very much outweighed by its bad qualities. To the man with early lambs, dirty, oaty stubbles are very profitable indeed after March rains, and by the wild oat being crossed with the cultivated oat we have recently derived the famous Sunrise oat. Some say that sheep spread wild oats by carrying them in their wool. This could only happen where oats are allowed to become dead ripe before stocking, but I seriously doubt it all the same, for they have nothing to hook on to the wool such as a thistle-head or burr has. If sheep with a full fleece were in a high ripening crop, which is unlikely, they certainly might carry some in their backs.

There is an old saying that once a man has sown his wild oats he is right. Well I can only say they must be a different variety from the one we have under review, because, once sown, these will take many years to get rid of them. To my mind the wild oat should be classed as a noxious weed.

ALTERATION OF NAMES OF MAIZE VARIETIES.

At the recent conference of Inspectors of Agriculture it was decided to alter the nomenclature of two varieties of maize which are now recommended to farmers by the Department in certain districts.

Sundown (formerly North-western Dent).—This variety was obtained from America two years ago under the latter name, and as this name is apt to be confused with a section of the State where maize is grown, and to which this variety has not been found suited, it was deemed advisable to alter it. Sundown is suggestive partly of its extreme earliness and of the bright red colour of the grain. The variety is recommended at present for good soils only on the coldest portions of the Northern Tableland.

Early Morn (formerly U.S. 133).—This variety was obtained from America three or four years ago under the name United States Selection 133. As names including a number are apt to lead to mistake and confusion (as this one already has), it was considered advisable to change its name entirely. Early Morn is suggestive of its bright golden-yellow colour and its very early maturity. The variety is recommended for the coldest portions of the Northern Tableland, and also as a hardy variety for upland soils on the western slopes.—H. WENHOLZ, Inspector of Agriculture.

Field Experiments with Wheat, 1921.

Cowra Experiment Farm.

C. McCAULEY, Experimentalist.

THE experiment was divided into four sections :—Section A, early planting for hay; section B, early planting for grain; section C, late planting for hay; section D, late planting for grain.

The soil is of granitic origin, and varies from a light sandy to a rather stiff clay loam. Variation is also caused by the scouring of the soil by heavy rain during previous years. The experiment area was sown with wheat experiments in 1919, and with rape as a fodder crop in 1920.

The land was disc-ploughed on 1st to 6th December, 1920, disc cultivated on 20th January, 1921, to 3rd February, and spring-tooth cultivated and harrowed on 14th to 17th March and 20th and 21st April The seed-bed was in ideal condition and free from weeds. All plots were harrowed crosswise on 13th and 14th April, 1921.

Sections A and B (early planting) were sown on 24th April, 1921, at the rate of 42 lb. per acre. Superphosphate was applied at the rate of 60 lb. per acre.

The plots germinated well and evenly, and made rapid growth during May and June. Dry frosty weather conditions set in during July and the plots received a severe set back, especially Bomen, which was badly frosted. Good rains fell during August and were followed by mild weather, and the plants made a good recovery. Hot, dry weather in October and November caused the varieties in the grain section to ripen prematurely; the yields were considerably reduced, and a pinched sample of grain was obtained. Warden and Cowra No. 30 made the best growth in the hay section Cowra No. 30 is a rust-resistant selection from Hard Federation; it was absolutely free of rust, although the plot along side of it (Cowra No. 29) was badly affected.

The hay section was cut with the reaper and binder on 25th October, 1921, and weighed on 7th November, 1921. The grain section was harvested with the stripper on 29th November, 1921.

The rainfall during the growing period was as follows :—

Month.	Points.	Days.	Month.	Points.	Days.
May	311	12	October	126	4
June	249	6	November... ...	119	4
July	183	5			
August	220	7	Total	1,391	46
September	183	8			

HAY Variety Trial (Early Planting).

Varieties in order of Merit.	Yield per acre (based on percentage yield). t.	ct.	qr.	lb.
Warden (Average of checks)	3	12	3	22
Wandilla (Cowra No. 20)	3	9	2	0
Cowra No. 30 (unnamed)	3	9	1	5
Bomen	3	4	1	25
Cowra No. 29 (unnamed)	2	19	1	22

OBSERVATIONS in Hay Variety Trial (Early Planting).

Variety.	Height. ft. in.	Strength of Straw.	Stooling.	Occurrence of Rust.	Occurrence of Take-all.
Warden*	5 6	6/10	6/10	2/10	......
Cowra No. 30* ...	5 6	6/10	5/10	......	......
Cowra No. 29 ...	4 6	3/10	5/10	4/10	......
Bomen*	4 6	4/10	5/10	1/10	1/10
Wandilla	4 0	7/10	7/10	4/10	4/10
Hard Federation...	3 6	7/10	5/10	5/10	1/10
Cowra No. 28 ...	3 6	4/10	6/10	1/10	......
Bathurst No. 17 ...	4 6	5/10	8/10	1/10	......

* These varieties were sown in the Hay section only.

GRAIN Variety Trial (Early Planting).

Varieties in order of Merit.	Yield per acre, based on percentage yield. bus.	lb.
Cowra No. 29	28	50
Hard Federation (Average of checks) ...	27	47
Bathurst No. 17	24	39
Wandilla (Cowra No. 20)...	23	41
Cowra No. 28	23	32

Sections C and D (*late planting*) were sown on 27th May, 1921, at the rate of 52 lb. of seed per acre. Superphosphate was applied at the rate of 60 lb. per acre All the plots germinated well with the exception of Waratah, which germinated patchily in both sections. The early growth was slow owing to the dry frosty weather experienced during July; good rains fell in August and September, and the plots made rapid growth, though the yields in the grain section were reduced by the dry hot spell experienced during October and November.

The hay section was harvested with the reaper and binder on 8th November, 1921, and weighed on 19th November, 1921. The grain section was harvested with the stripper on 30th November.

The rainfall during the growing period was as follows:—

Month.	Points.	Days.	Month.	Points.	Days.
1921.					
May 27th to 31st ...	45	2	October	126	4
June	249	6	November	119	4
July...	183	5			
August	220	7	Total	1,125	36
September	183	8			

HAY Variety Trial (Late Planting).

Varieties in order of Merit.	Yield per acre. t.	ct	qr.	lb.
Cowra No. 30	3	1	2	24
Clarendon	2	18	3	5
Firbank (Average of checks)	2	18	2	21
Gresley	2	17	2	8
Waratah (Wagga No 47)	2	8	2	1

OBSERVATIONS in Hay Variety Trial (Late Planting).

Variety.	Height.	Stooling	Strength of Straw.	Occurrence of Rust.	Occurrence of Take-all.
	ft. in.				
Hard Federation ...	3 6	6/10	7/10	4/10	......
Cowra No. 28 (Not named) ...	3 0	6/10	4/10	1/10	......
Cowra No 29 (Not named) ...	3 0	5/10	4/10	2/10	......
Waratah	3 0	6/10	6/10	1/10	......
Gresley	4 0	7/10	7/10	1/10	......
Wilfred	3 6	7/10	7/10	...	......
Canberra	3 6	6/10	4/10	1/10	......
Fairbank*... ...	3 6	6/10	4/10	2/10	......
Cowra No. 30 (Not named)* ...	4 0	5/10	7/10	...	......
Clarendon* ...	4 0	5/10	5/10	1/10	......

*These Varieties were sown in the Hay Section only.

GRAIN Variety Trial (Late Planting).

Variety in order of Merit.	Yield per acre (based on percentage yield). bus.	lb.
Canberra	36	39
Gresley	29	6
Hard Federation (Average of checks) ...	27	22
Wilfred	26	51
Waratah (Wagga No. 47)	26	47
Cowra No. 28	24	55
Cowra No. 29	23	57

Notes on Varieties.

Warden yielded best in the early planted hay section, and has again proved itself one of the best hay varieties for early sowing in this district. It yields a large amount of excellent hay.

Cowra No. 29 (Hard Federation x Cowra No. 19) gave the highest yield in the early planting grain section, though it gave the lowest yield in both the early planting hay and late planting grain sections. On this season's results it is a promising grain variety for early planting, but unsuitable for hay.

Cowra No. 28 (selection from Yandilla King) has this season shown itself a poor grain yielder.

Cowra No. 30 (selection from Hard Federation) yielded well in both early and late planting hay sections. It produces an excellent sample of hay. On this season's observations it appears to be very rust resistant.

Bathurst No. 17 (Hard Federation x Cleveland) is a tall-growing variety. It promised to yield well, but is too late for this district. It produced a very pinched sample of grain.

Waratah (Wagga No. 47) is a promising grain variety. On this season's results the hay yields are low, probably due to patchy germination.

Clarendon and Firbank are two useful hay varieties for midseason and late sowing. Firbank yields the better sample of hay but is susceptible to loose smut (*Ustilago tritici*).

Canberra gave the highest yield in the late section. It yields an excellent sample of grain. It has very weak straw and in this district should be sown late. If sown early it is liable to lodge, and therefore should be fed off.

Hard Federation is one of the most suitable varieties for this district, but it is susceptible to rust.

Gresley is a valuable dual purpose variety for midseason and late planting in this district. It will probably replace Firbank as a hay variety.

Wandilla (Cowra No. 20) is a dual purpose variety. The yield was reduced in the early planting grain section by patches of take-all.

TRINIDAD DASHEEN (*Colo asia exulenta*)

SMALL consignments of the plant, popularly known as Trinidad Dasheen, were received several years ago by the Government Botanist, Mr. J. H. Maiden, and tried in the Sydney Botanic Gardens, where they gave fairly promising returns. Dasheen carries large corms, which are boiled or baked and served much as potatoes are, and the shoots are also considered attractive, the flavour being delicate and suggestive of mushrooms.

From the Botanic Gardens corms were sent to Wollongbar and Grafton experiment farms, the behaviour of the plants having suggested that they should have a warm climate with an ample rainfall. At both institutions, however, the crop was a failure, and after several seasons the trials have been discontinued.

Varieties of Maize.

RECOMMENDATIONS BY THE DEPARTMENT OF AGRICULTURE.

THE Department has recently revised the list of varieties of maize recommended for various districts, based on the results of experiments which have been carried out throughout the State :—

Classification of Maize Districts.

The maize districts of the State are classified as follows for the purpose of these recommendations :—

1. Upper North Coast, comprising the Tweed, Richmond, Clarence, Bellinger, and Nambucca Rivers.
2. Middle North Coast, comprising,—(*a*) Macleay and Hastings Rivers, and (*b*) Manning River.
3. North Coast Tablelands, comprising Dorrigo and Comboyne districts.
4. Central Coast, comprising county of Cumberland, and Hunter and Hawkesbury River districts.
5. South Coast comprising—(*a*) Illawarra, Shoalhaven, and Milton districts, (*b*) Moruya and Tilba districts, (*c*) Bega district.
6. Northern Tableland, comprising Tenterfield, Glen Innes, and Armidale districts.
7. Central Tableland, comprising Bathurst district.
8. Southern Tableland, comprising Moss Vale district.
9. North-western Slopes, comprising—(*a*) Inverell district. (*b*) Tamworth and Upper Hunter districts.
10. Central-western Slopes, comprising Molong, Manildra, Mudgee, Canowindra, and Coonabarabran districts.
11. South-western Slopes, comprising Tumut district.
12. Murrumbidgee Irrigation Areas.

Approximate Order of Maturity of Varieties Recommended.

Very Early.—Sundown (formerly North-western Dent), Early Morn (formerly U.S. 133), Golden Glow.

Early.—Wellingrove, Golden Superb, Iowa, Silvermine, Funk's Yellow Dent, Goldmine, Craig Mitchell.

Midseason.—Hickory King, Boone County White, Leaming, Manning Silvermine, Golden Nugget, Early Clarence, Manning White or Macleay White, Golden Beauty.

Late.—Yellow Hogan, Yellow Mastodon, Fitzroy, Large Red Hogan, Yellow Moruya, Ulmarra Whitecap.

Varieties Recommended for Grain.

UPPER NORTH COAST.

Early crop—Leaming.

Main crop—Fitzroy, Ulmarra Whitecap.

Second-class soils—Hickory King, Leaming, Golden Nugget.

MIDDLE NORTH COAST.

(*a*) *Macleay and Hastings Rivers.*

Early crop—Golden Superb.

Main crop—Fitzroy, Large Red Hogan, Yellow Hogan.

Second-class soils—Hickory King, Macleay White, Golden Nugget.

Blight-resistant varieties for November and December sowing—Fitzroy, Golden Nugget.

(*b*) *Manning River.*

Early crop—Funk's Yellow Dent, Craig Mitchell.

Main crop—*Lower Manning:* Large Red Hogan, Manning Silvermine, Fitzroy, Ulmarra Whitecap.

Main crop—*Upper Manning:* Golden Beauty, Fitzroy, Manning White, Leaming.

Second-class soils—Hickory King.

Blight-resistant variety for November and December sowing—Fitzroy.

NORTH COAST TABLELAND.

Leaming, Golden Superb, Golden Nugget.

CENTRAL COAST.

Early crop—Funk's Yellow Dent, Iowa Silvermine, Craig Mitchell.

Main crop—Fitzroy, Ulmarra Whitecap, Large Red Hogan.

SOUTH COAST.

(*a*) *Illawarra, Shoalhaven, and Milton Districts.*

Early crop—Funk's Yellow Dent, Goldmine.

Main crop—Funk's Yellow Dent, Leaming, Fitzroy, Large Red Hogan, Boone County White.

Second class soils—Hickory King.

(*b*) *Moruya and Tilba Districts.*

Early crop—Funk's Yellow Dent.

Main crop—Boone County White, Large Red Hogan, Yellow Moruya.

Second-class soils—Hickory King.

(*c*) *Bega District.*

Early crop—Iowa Silvermine, Goldmine, Funk's Yellow Dent.

Main crop—Fitzroy, Large Red Hogan, Boone County White, Yellow Mastodon.

Second-class soils—Hickory King.

NORTHERN TABLELAND.

Wellingrove, Funk's Yellow Dent, Golden Glow.

For colder portion of the Tableland (Black Mountain to Ben Lomond)—Early Morn (formerly U.S. 133), and Sundown (formerly North-western Dent).

CENTRAL TABLELAND.

Alluvial soils—Funk's Yellow Dent, Iowa Silvermine.

Upland soils—Wellingrove, Funk's Yellow Dent, Iowa Silvermine.

Colder districts—Early Morn (formerly U.S. 133).

SOUTHERN TABLELAND.

Early Morn (formerly U.S. 133), Golden Glow.

NORTH-WESTERN SLOPES.

(a) *Inverell District.*

Main crop—Funk's Yellow Dent, Iowa Silvermine.

Later sowing—Wellingrove.

(b) *Tamworth and Upper Hunter Districts.*

Alluvial soils—Funk's Yellow Dent.

Upland soils—Early Morn (formerly U.S. 133).

CENTRAL-WESTERN SLOPES.

Alluvial soils—Funk's Yellow Dent, Iowa Silvermine, Early Clarence.

Upland soils (September or December sowing recommended)—Funk's Yellow Dent, Iowa Silvermine, Early Morn (formerly U.S. 133).

SOUTH-WESTERN SLOPES.

Alluvial soils—Early Clarence, Funk's Yellow Dent.

MURRUMBIDGEE IRRIGATION AREAS.

Iowa Silvermine, Funk's Yellow Dent (December sowing recommended).

Varieties Recommended for Green Fodder.

COASTAL DISTRICTS.

Early varieties—Hickory King, Leaming.

Late variety—Fitzroy.

TABLELAND DISTRICTS.

For warmer portions—Fitzroy.

For cooler parts—Hickory King, Leaming.

For coldest portions—Wellingrove.

WESTERN SLOPES AND MURRUMBIDGEE IRRIGATION AREAS.

Fitzroy.

Varieties of Potatoes.

RECOMMENDATIONS OF THE DEPARTMENT OF AGRICULTURE.

THE Department has recently revised the list of varieties of potatoes recommended for various districts, based on the results of experiments which have been carried out throughout the State :—

NORTH COAST.

Up-to-date, Satisfaction, Early Manhattan.

LOWER NORTH COAST.

Early Manhattan, Satisfaction, Up-to-date, Factor.

SOUTH COAST.

Up-to-date, Early Manhattan, Early Manistee.

NORTH COAST PLATEAU (Dorrigo and Comboyne).

Langworthy, Factor, Coronation.

NORTHERN TABLELAND.

Main crop—Coronation, Factor, Surprise.
Early crop—Satisfaction, Early Manhattan.

SOUTHERN TABLELAND.

Factor, Up-to-date.

SOUTH-WEST TABLELAND (Batlow and Tumbarumba).

Main crop—Factor, Coronation.
Early Crop—Early Manistee, Early Manhattan, Carman No. 1.

CENTRAL TABLELAND.

Main crop—Factor, Late Manhattan, Surprise.
Early crop—Early Manhattan.
Main crop for Oberon district—Early Rose, Satisfaction, Factor.

MURRUMBIDGEE IRRIGATION AREAS.

Up-to-date, Early Manhattan, Early Rose.

FRENCH BEAN FLY (*Agromyza phaseoli*).

THESE tiny black flies lay their eggs in the tissue of the stem of the French bean, and the maggots feeding on the stems cause them to decay and snap off. The only remedy we can suggest is banking the beans up with earth right up to the stems, so that the action of the fly is checked and the beans may be able to throw out a fresh growth of roots above the damaged portion. This is the method adopted in the Gosford district by the bean growers, and in ordinary seasons the beans recover to a certain extent. Clean cultivation and the removal and destruction by fire of all old bean stalks when the crops are gathered are also suggested.—W. W. FROGGATT, Government Entomologist.

Sheep on the Mixed Farm.

ARE THEY A NECESSITY ?

THE question, " Are sheep necessary to successful farming in this district? " lately provoked a full-dress debate in the Springside branch of the Agricultural Bureau, the " pros and cons " being argued out with some intensity and a good deal of local interest.

The " Ayes " contended that although Springside district was not so suitable as the far west, still it was highly advisable to keep sheep as essential in connection with mixed farming. Live stock—sheep in particular—played a large part in helping to maintain the fertility of the soil by keeping up a constant supply of humus, through the judicious grazing of green crops. Even a few sheep were a decided asset, as many farms had portions unsuited for cultivation, which from time to time could with decided pecuniary advantage carry a small number of sheep, and thereby increase the farmer's revenue. Sheep also acted beneficially in keeping down noxious weeds of all descriptions.

The " Noes " contended that sheep were consumers, and as farmers were essentially producers, by keeping sheep they were materially restricting the area capable of being sown to hay, upon which farmers in the district relied for their living. Owing to a good average and regular rainfall, farmers were always able to grow hay, and therefore should take advantage of the exceptional conditions to produce as much as possible, in order to have plenty to sell at an enhanced price during those periodical droughts that swept other parts of the country. It was also claimed that it was decidedly bad business to run sheep on rich cultivation land, the return per acre being so very much less than that from hay or potatoes. It was also questioned whether sheep did materially improve the fertility of cultivation land, because it was claimed they merely transferred portion of the farm in the shape of green fodder, and deposited it—at a loss—on another part of the farm in the shape of manure. It was claimed that the green fodder would have produced manure without loss had it been ploughed under instead of being eaten off.

At the end of an interesting debate the adjudicator—Mr. S. A. Hoey—announced that the " Ayes " had won by 6 points, a decision that was well received by the meeting

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Mr. A. H. E McDonald, Chief Inspector of Agriculture, commenting upon the foregoing, remarks that the decision is generally sound. On no farm is the work so well regulated that weeds can be kept entirely in check by cultivation, and there is no way of keeping them in control (and at a

profit) better than grazing them down with sheep. Local conditions must at all times be considered, but when a long view is taken it is apparent that live stock must be kept upon the farm to maintain its fertility. The continual production and sale off the farm of hay, potatoes, &c., is most exhausting.

THE RELATIVE VALUES OF CROSSBREDS AND MERINOS.

At a meeting of the Warrah Creek branch of the Agricultural Bureau, Mr. D. Martin read a paper which discussed this subject from an interesting point of view. The principal portions of the paper follow :—

This is a subject which can be looked at from many points, each of which will bring about different conclusions. Much depends on the class of country and area of the run when it comes to deciding which breed will give the best returns. Taking a mixed farm of 250 to 300 acres of rich heavy land, such as our own district, I should be inclined to favour crossbreds, one reason being that they invariably give a far better percentage of lambs. The lambs, too, as a rule are worth more than merinos at the same age, especially if they are fit for the fat lamb market, as they should be if reared on a mixed farm. This gives a bigger and quicker return, which on a small area is a big consideration, for on the small area the sooner the surplus stock is disposed of the better. There is also a greater loss of merino ewes at lambing than of crossbreds.

As a rule, and particularly at the present time, the fleece from the crossbred is not nearly as valuable as that of the merino if clean, but if both were run on the class of land mentioned above, then the difference in favour of the merino would not be very great, as both would be burry and heavy, and, as the merino is inclined to pick up more burr than the crossbred, it would suffer more in price. Then, again. there is the matter of attention required by each at lambing time, and when the blow-fly is troublesome it is quite safe to say that the time occupied in looking after a merino flock would be three times that for crossbreds. These are considerations in these days of high-priced labour, as time is money, even to the mixed farmer.

Although the price paid to the shearer is the same in both cases, there is nevertheless a saving in favour of the crossbred, as they can be done much quicker, and if shorn by machinery a saving in oils and wear and tear of machinery is effected. On a flock of 300 there would be a saving of a day for all, and if the farmer were to do his own shearing, then the saving would be greater. Allowing 30s. for shearing, 20s. for shed hands, and not forgetting fuel and oil for engine and machinery, this would amount roughly to 20s. per hundred.

Another consideration is the difference in the amount of capital which will be required for stocking up. The crossbred ewe is usually from 4s. upwards, cheaper to purchase, and if profits are reckoned by percentage on the outlay of capital they help the crossbred again.

These remarks apply to the mixed farmer chiefly, but the case of a small grazier with from 600 acres or more is different. Provided the country was free from seed or burr, and not adapted to fattening, then I do not doubt that the merino would be the better breed to keep. Much, of course, depends on the market for wool and fat stock. A rough table will give an idea of their relative values in figures :—

	£ s. d.	£ s. d.
300 Crossbred Ewes.		
90 per cent. lambs = 270 lambs, at 16s ...	216 0 0	
5 lb wool each. at 6d. ...	37 10 0	
Total ...		£253 10 0
300 Merino Ewes.		
65 per cent. lambs = 195 lambs, at 11s. ...	107 5 0	
6 lb. wool, each at 9d. ...	67 10 0	
Total ...		£174 15 0
Difference in favour of Crossbreds ...		£78 15 0

Allowance for the extra time required for shearing and other items, such as lambing, blow-fly treatment, and eye-clipping, will make the position of the merino less favorable still.

It may be remarked in reference to this paper that the price credited to the merino wool is rather too low, and unnecessarily prejudicial to the case for the merino. Mr. F. B. Hinton, Sheep and Wool Expert, remarks that on small areas, such as those described, lamb-raising would certainly be found a much more profitable line than any other kind of sheep farming, principally on account of the quick return obtained, and because the disposal of the natural increase at the lamb stage does not unduly tax the carrying capacity of the land. Care must be exercised in selecting the best combinations of breeds for this purpose. Departmental tests have proved that the Dorset Horn ram crossed on the first-cross Border Leicester-merino ewe is best suited for the production of early lambs.

A TIMELY REFERENCE.

THE value of a reference to the Department was illustrated by a grazier on the Southern Tableland lately. It was observed that some sheep in a lucerne paddock were apparently affected by eating a certain plant that was growing among the lucerne, and from their appearance death appeared likely.

The specimen forwarded was submitted to Mr. J. H. Maiden, Government Botanist, who quickly identified it as hemlock (*Conium maculatum*), a well-known poison plant, most deadly to man and beast.

A telegram was despatched at once informing the grazier of the identity of the plant, and in acknowledging this a few days later, he remarked that a number of sheep had been lost in the paddock without any other known cause. Other pastoralists in the district should be on the look out for hemlock, which is illustrated in Mr. Maiden's "Weeds of New South Wales."

A New Method of Harvesting Grain Sorghum Seed.

J. N. WHITTET, **Agrostologist.**

UNTIL recently the main drawback in harvesting this crop was due to the fact that it entailed a considerable amount of hand-harvesting of heads, or as an alternative method, the cutting of the whole of the crop with a maize binder or reaper and binder, and when the heads were dry threshing the grain from them by means of the ordinary grain thresher. With the spread of the reaper-thresher and header in wheat districts (grain sorghums are grown in these localities), a solution to the harvesting difficulty has been arrived at, as a recent trial with this machine in crops of grain sorghum at Cowra Experiment Farm demonstrated. It was readily acknowledged by those present that the machine and horses worked more freely in this crop than in the case of an ordinary crop of wheat, so that the capacity of the machine was in no way overtaxed.

A Crop of Feterita before Harvest.

A number of adjustments were made to the thresher-drum during the test, and it was found that by setting the drum down as low as possible the grain was thoroughly cleaned off the head, and at the same time a very small proportion of cracked grain resulted. In order to allow the stalk just below the head to come freely into contact with the knife of the comb, every alternate finger of the comb was removed; but in some makes of reaper-thresher the removal of the fingers is unnecessary, as provision is made for adjusting the width of the comb-fingers. The machine satisfactorily handled three rows at a time, the drills being 3 feet apart, the material being collected and threshed most effectively when the heads were cut with from 3 to 4 inches of stalk attached; the drills were 5 chains long, and the average time taken to harvest an acre was 40 minutes.

The Crop of Feterita after the Reaper-thresher had been through it.

As the reaper-thresher has not a large range of adjustment as regards height of comb, it cannot successfully harvest crops over 5 feet high, as too much stalk for the machine to handle has to be cut with the heads, with the result that the thresher-drum cannot do effective work As the majority of grain sorghum crops are grown in the drier parts of the State, it is very seldom that they attain a height of more than 4 feet, especially when Milo or Feterita (our two best varieties) are grown.

Emptying the Grain Box.
The Feterita seed, which is white in colour, is being bagged.

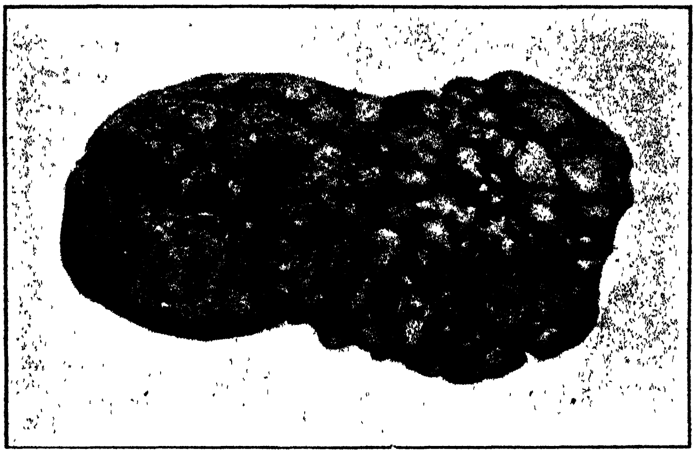
For the machine to do good work the grain must be thoroughly ripe, and the stalk under the head dry.

ATTACKS OF EELWORMS ON POTATOES.

THE accompanying illustration of a potato attacked by eelworms shows the extent to which damage may be done by these little pests. The case is, no doubt, a very severe one, but it will serve to indicate to growers what they should be on the lookout for.

This specimen came from highly-priced land that had been planted with potatoes for many years, and it therefore illustrates the need for methods of cultivation that will keep the ground clean.

Growers who observe such a condition in their crops should avoid the use of the crop for seeding purposes, as the disease may be conveyed in the seed to clean land, and once contaminated the soil will remain so for many years. The only practical methods of control are the selection of clean seed, and the adoption of a rotation of crops. Affected land should not be planted with potatoes for several years, but should be put down to cereals or grass, as the eelworms do not attack these crops. Dipping tubers. in the hope of cleaning the seed, is useless —A. J. PINN, Inspector of Agriculture.



The effect of attacks of Eelworms on a Potato.

WHITE GRUBS DAMAGING A WHEAT CROP.

A RIVERINA farmer lately referred to the Department about damage to his wheat done by grubs. They worked under the soil, biting through the plant just above the seed, and completely destroying patches of the growing wheat.

The Government Entomologist replied. that the specimens sent were the larvæ of a Lamellicorn beetle, which was a serious pest of strawberry beds, vegetable gardens, and cultivated grasses. The difficulty in dealing with them in field crops was that the damage was usually done before their presence was noticed. Spraying, fumigation, and treatment of the soil with mixtures were all impracticable or too expensive, and the only satisfactory method was to turn the soil over, exposing the grubs so that birds could pick them up. They usually fed in the soil for a considerable time before changing into pupæ, but they were generally local, and did not spread over the whole area.

A Modern Pasteurising Plant.

O. C. BALLHAUSEN, **Dairy Instructor.**

ONE of the Richmond River factories that has recently changed from the flash process of pasteurising to the holding process has now one of the most effective and economical systems in use, and is worthy of description in the interests of other factories.

No live steam is used for pasteurising or for operating the pumps for the circulation of water or brine, and this has effected a saving in the consumption of coal of half to three-quarters of a ton per day, and overtime work has been quite eliminated.

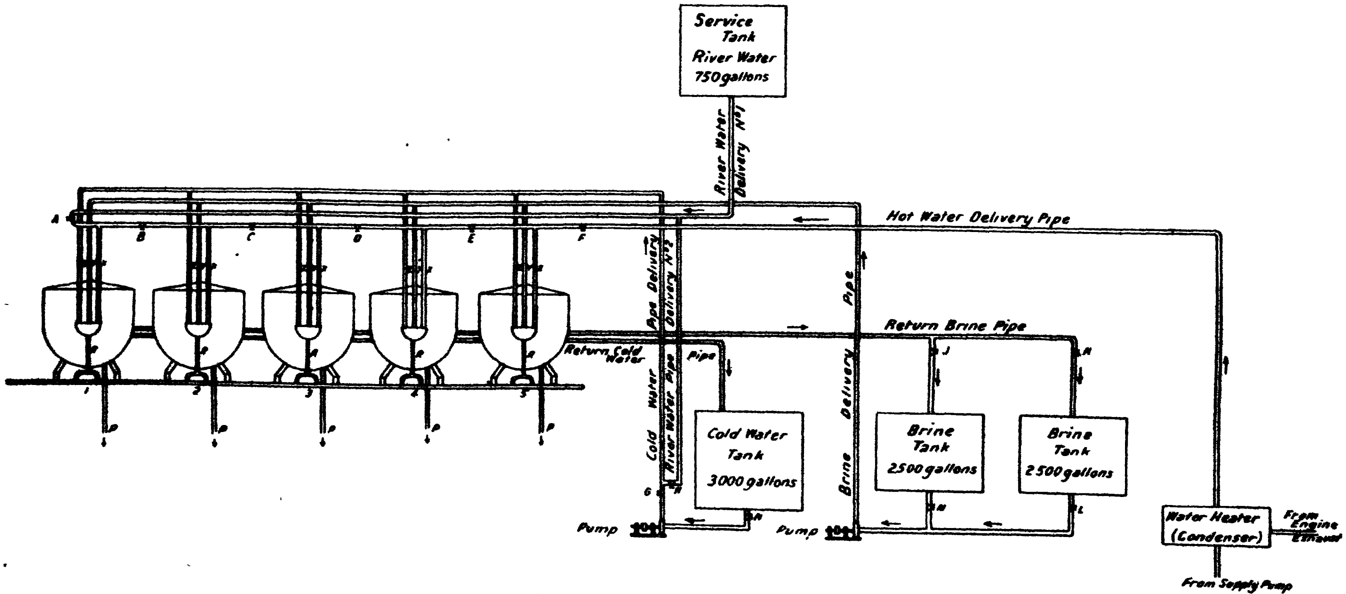
All hot water for pasteurising, washing up, &c., is secured by exhaust steam; and brine and cold water circulation is obtained by using small belt-driven centrifugal pumps Water is heated by being passed through an old surface steam condenser, connected with the engine exhaust, and is delivered to the pasteurisers at a temperature of 180 to 200 degrees Fah. The pump which forces this water through the condenser to the pasteurisers also supplies the elevated service tank, and the water in this tank is at atmospheric temperature.

It will be noted on reference to the sketch plan that the water tubs generally supplied with these pasteurisers have been discarded, and four pipes have been provided instead for supplying the necessary heating and cooling media, viz , hot water, river water, cold water, and brine. An unusual feature with this type of installation is the use of a 3,000-gallon tank of cold water for the second cooling operation. This tank of water is maintained at a temperature of about 50 degrees Fah., and is cooled by the return ammonia pipes from the cool rooms, &c., passing through it.

Two tanks of brine of 2,500 gallons each have also been provided, and are used alternately during the day's cooling. This has been found a greater convenience than having one large supply tank

The practice is to heat the cream to 145 degrees, which takes from forty-five to sixty minutes, cool to 100 degrees with river water, cool further to 60 or 70 degrees with cold water, and finally to 44 degrees with brine. The whole process for each vat takes from three and a half to four hours, inclusive of holding the cream at 145 degrees for thirty minutes.

It will be seen that a number of water valves on the hot water pipe makes possible the use of one pipe-line for the delivery of hot water or river water to the pasteurisers, and by following the explanation given and studying the sketch the operation is easily understood.



Outline Sketch of Pasteurising Plant Utilising Exhaust Steam.

A B C D E F. Hot Water Valves.
G H J K L M N. Cold Water and Brine Valves.
P. Exhaust Hot Water and River Water Pipes.
1 2 3 4 5. 800-gallon Batch Pasteurisers.

X. Hot Water and River Water Pipe.
Y. Brine Pipe.
Z. Cold Water and River Water Pipe.

We will assume that No. 1 vat has been filled with cream and is ready to pasteurise. The water valve at A is closed; when closed this valve prevents the river water from the service tank or the hot water from the water heater mixing. All the valves B, C, D, E, and F are open, as well as the hot water inlet valve on the No. 1 pasteuriser. It has already been stated that valve A is closed, so that the hot water must pass through the pasteuriser and heat the cream.

When the cream is ready to be cooled, valve B is closed and valve A opened. By closing valve B, hot water cannot pass. This permits the river water from the service tank to pass through the pasteuriser coil by gravitation. It will be seen that this water enters the coil by the same inlet as the hot water formerly entered, and escapes through the hot water outlet marked P at the back of the pasteuriser.

The Interior of the same Factory

Note the pipes supporting the gear cases.

Whilst the cream in No. 1 pasteuriser is cooling, the hot water can now be delivered through the coil of No. 2 pasteuriser. Valve B being closed, will not permit hot water to pass, and it must enter the coil of No. 2 pasteuriser in the same way as has been described in the case of No. 1 pasteuriser.

The same process applies to No. 3. By closing valve C hot water enters this pasteuriser, and by closing the hot water inlet valve on No. 1 pasteuriser and leaving valves A and B open river water from the service tank may enter the coil of No. 2 pasteuriser.

This arrangement of opening and closing the valves on what is termed the hot water delivery pipe, allows the five vats to be heated and cooled one after the other. It will be seen on a further study of the sketch that if it is desired to use the river water from the service tank on two vats at the one time by opening valve H and closing valve G this water will gravitate through the cold water delivery pipe to any pasteuriser required. Whilst using the cold water pipe-line in this way the cold water tank would, of course, be idle. It will also be seen that the cold water is returned to its tank and is not wasted. The hot water and river water, after use, are allowed to escape. The deliveries and return of the cold water and brine can be easily understood.

By the arrangement of piping shown, all five vats may be operated at the one time—No. 5 vat may be heating, No. 4 using river water, No. 3 using cold water, and Nos. 2 and 1 using brine.

It should be understood that none of the valves attached to the pasteurisers have been removed, although not shown, as they are all required in operating the machines. All piping is 2-inch galvanised, and is supported near the pasteurisers by being bolted to heavy posts at the edge of the cream room; and as an extra support, and also to remove any possible strain from the driving gear casing and packing glands, a pipe support, marked R in the sketch, is placed between the case and floor. This consists of a piece of 1½-inch pipe about 2 feet long, one tee-piece and two bends for each vat. The pipe is fitted with a long thread at one end, and this is screwed well into the tee-piece.

After placing the assembled parts between the casing and floor, the pipe is slowly screwed outwards from the tee until it is securely gripped between the floor and gear casing. It will be seen that by using the bends in this way, that room is left for cream fluming or piping from the vat taps to the churns.

The arrangement of piping shown can be used wherever hot water is secured in bulk.

The method of forcing it through the hot water delivery pipe is, of course, a matter that would have to be determined as the facilities at individual factories permitted; but the principle of utilising exhaust heat for obtaining a large quantity of hot water for pasteurising and other purposes is one that can be adopted with advantage.

HOW TO GROW GINGER.

GINGER is a sub-tropical plant that requires a warm climate, plenty of moisture, and a fertile soil, which should have been thoroughly prepared. Small pieces of healthy root are planted in October. in trenches 18 inches apart, 12 inches apart in the rows, and 3 inches deep. During growth the bed must be kept free from weeds, and the crop may have to be watered if the weather is dry. When the stems start to turn yellow it is time to lift the crop. At this stage care should be taken that the roots do not get wet, as they then lose their pungency. When the stems have turned quite yellow the roots should be washed and scraped, and sun-dried on lattice-work. For future planting the roots may be kept over the winter in dry sand. For preserving, the roots should be dug while the plant is green, so that the roots are tender and succulent.

Recent Changes in Farming Practice on the South Coast.

R. N. MAKIN, Inspector of Agriculture.

IN reviewing farming operations of recent years on the South Coast and Southern Tableland, one must admit that there have been many changes of late on all sides, there being a general desire on the part of farmers and graziers to improve their holdings and better their methods of working them.

This has been brought about, perhaps, in many ways. No doubt the high prices for farm products have directed many towards the cultivation of crops, especially green fodder crops for dairy cattle, with a view to increasing the milk output. The price of maize has also tempted many to try to improve on the past. A forward move in maize-growing is indicated in the way in which farmers have submitted varieties of their own selection to be sown alongside others on experimental plots run by the Department. Boys' maize-growing competitions, promoted by branches of the Agricultural Bureau and by Agricultural Associations, also indicate the spirit of progress.

The wonderful demand for seed of wheat and oats of recent introduction, must certainly point to the success of the farmers' experiment plots inaugurated fourteen years ago by the Department of Agriculture. To-day the demand for pure seed of Sunrise oats is greater than the supply, and the same applies to Thew wheat. New barleys, bred by the Department are ousting the older types. Heavy demands for seed supplies are being made on the Government experiment farms, which, however, are unable to meet requirements, and many farmers are now anxious to be registered on the pure-seed-growers' list. No doubt a good supply of reliable seed will shortly become available through this medium.

In dairy-farming, progress is still being made in the conservation of ensilage, and there must now be about 300 silos in the district. More attention is being paid to the growing of suitable crops for silage, and better methods of cultivation are practised. The cost of production is also being studied.

The potato-growing industry, more especially in the Crookwell district—where approximately an area of 4,000 acres is annually planted—is showing signs of improvement. Through the agency of the local branch of the Agricultural Bureau, an amount of information has been gathered in respect to the cost of production. Farmers' variety trials have been productive of many changes in local varieties, and the selection of seed and ideas on planting have also been influenced for good. Much interest is now taken in vegetable-growing, particularly around Shoalhaven, where in some parts dairy-farming has given place to vegetables—especially cauliflowers and peas.

Poultry farmers have learned that green fodder plants are required in successful poultry-raising, and as much as 33 per cent. of finely-chopped greenstuff is added to the morning mash, with excellent results. At Miranda, where a most flourishing branch of the Agricultural Bureau exists, a competition amongst poultry farmers is now being conducted over a period of twelve months with green fodder plants suitable for poultry, the desire being to ascertain the best classes of stuff to grow during the different seasons of the year.

Farmers and graziers are everywhere very keenly interested in improving their pastures. It is recognised that perennial rye grass does not form the pasture it did in past years, largely due to the ravages of rust, and other grasses are now sought. Consequently grass experiments are popular. This is a matter which requires serious consideration, but under existing conditions little can be done.

On the Monaro, tractors are now seen on areas which lend themselves to their use. They will, perhaps, be found useful in cultivating the lucerne stands, of which there are some large areas.

HICKORY KING MAIZE CONTEST.

ENTRIES are invited from farmers who grow Hickory King maize for a "yield contest" which is being arranged by the Department of Agriculture under the following conditions:—

1. The contest is designed to be a test for the best yielding strain of Hickory King seed maize in the State.
2. Each competitor should send ten (10) pounds of his competing seed to the Under Secretary, Department of Agriculture, Sydney, before 31st August, 1922.
3. Three farms will be selected on the coast with as uniform land as possible (one each on North, Central, and South Coast), on each of which a plot of the competitor's maize will be sown under identical conditions; the field will be given the same cultivation treatment throughout.
4. The Department reserves the right to exclude any entry which does not conform to the standard type and purity of seed.
5. After harvesting and weighing the maize, the produce will remain the property of the farmer on whose land the test was conducted.
6. Fertilizer may be used at the option of the farmer on whose land the test is made, in which case the amount used will be the same on each plot.
7. When the crop is ready to harvest, an equal area of each plot will be pulled, husked, shelled, and weighed, and the best yielding strain of seed will be determined by that seed showing the best average yield on the three farms on which the test is conducted.

Deep Ploughing and "Knifing."

A. N. SHEPHERD, Inspector of Agriculture.

ALTHOUGH deep ploughing may be said to be almost in the experimental stages—at all events in so far as the Murrumbidgee Irrigation Areas are concerned—quite large areas of land have been treated with the "knifer," an implement used for the deep cultivating of land.

As is well known, most of the sub-soil on these areas consists of a heavy clay overlying a nodular limestone formation, and the object of the deep ploughing is to mix this formation with the clay and thus provide a greater depth of soil for water percolation and water storage in the soil for the future use of plants.

The plant used for deep ploughing on the areas was imported from England at a cost of £8,000, and consists of two Fowler traction engines and steam plough, together with the necessary travelling and camp equipment for the use of those employed on the work. Direct haulage is not employed, the plough being pulled by what is termed "winding," that is, one engine remains stationary at each end of the field, and the winding-drum of the engine, with a steel cable, is used to pull the plough. The plough used is of the single-furrow type, but of huge dimensions. It is really two single-furrow ploughs made and joined together in such a way as to be head on, so that when one furrow is being ploughed the other portion of the plough is held in the air, and is used on the return journey. This arrangement dispenses with the necessity of the plough turning round at the end of the land, and allows of the paddock being ploughed and the soil turned all the one way. In other words, it is really a one-way plough hauled by tractor.

When ploughing, a skim-plough coulter removes the top 6 to 9 inches of soil before the main furrow is turned. The sod is not completely overturned, but quite a lot of the subsoil and clay are brought to the surface. It is claimed that on a single shift the plant is capable of ploughing 12½ acres in the week, and it is estimated that the cost is approximately £5 per acre, allowing for labour, wear and tear, supervision, &c.

After ploughing, the land is allowed to remain in the rough for some considerable time. It is then worked down with the steam cultivator, which does about 25 to 30 acres per week. It has been found advisable to cultivate both ways, the cost for the double cultivation being 35s. per acre.

Where land is "knifed"—that is, a cultivator is used in place of the plough—the operation, which is usually carried out to a depth of 2 feet 6 inches to 3 feet, and both ways, costs £5 per acre.

When deep-ploughing is done, it is found best to plough across the fall of the land; this reduces the amount of work necessary in grading later.

Deep ploughing was carried out by the Water Conservation and Irrigation Commission on good land at Yenda a few years ago, lucerne being sown later. It was claimed by officers of the Commission that the increased yields of hay obtained fully warranted the expense in deep ploughing. A number of experiments are now started on the area on the poorer class of soil.

Certain land was "knifed" in 1920 and sown with grasses. The following paragraph is taken from a report recently published by the Water Conservation and Irrigation Commission:—

"It is a point of considerable interest to note that the grasses on the portion of the paddock that was 'knifed' were very much better than those growing on the balance of the plot. This distinction was noticeable right to the last stroke of the knife."

NEW YORK OBSERVATIONS ON TAKE-ALL.

THE following observations on take-all, based on research work by Dr. R. S. Kirby,* of Cornell University, New York State, U.S.A., are of interest:—

1. It has been established that a disease found in the States is identical with "take-all" in Australia, and of the same severity: the causal organism was isolated and determined as *Ophiobolus cariceti* (B. and Br.) Sacc. of which *O. graminis* is a synonym.
2. The most typical symptom of the disease is dwarfing of the host, which includes reduction in height, in number of tillers, in number of heads, and in size and amount of grain produced. The yield of an infected wheat plant was, on the average about 1 per cent. that of a healthy plant.
3. Various cereals, *e.g*, wheat, barley, rye, and wild grasses of the genera *Agropyron*, *Bromus*, *Elymus*, *Festuca*, *Hordeum*, *Hystrix*, *Lolium*, and *Phalaris*, were readily infected.
4. Seed from diseased plants did not act as carriers of the disease, but bits of infected straw were very effective means of passing on the disease.
5. Methods of control suggested are:—The practice of four to five year rotations; eradicating wild grass and volunteer crops which may act as hosts; discontinuing the practice of returning wheat stubble in manure for three years preceding the planting of wheat; cleaning the wheat seed thoroughly to remove all bits of straw which might carry perithecia; and discontinuing the practice of liming the soil before planting wheat.

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* Kirby, R. S. The take-all disease of cereals and grasses. *Phytopath* vol. 12: pages 66–88. 1922.

The Value of Crop Competitions.

H BARTLETT, Inspector of Agriculture, Western District.*

ANY person who has been associated with the conduct of any sort of crop-growing competition, and has speculated as to the significance of such contests in relation to everyday local farm practice, cannot but come to the conclusion that they are, and promise to be, a powerful factor in agricultural progress. That their educational value benefits not only the farmers competing, but eventually all the farmers in the district, has nowhere been proved more conclusively than in the wheat-growing districts of New South Wales. In the Wagga and Narromine districts wheat-growing methods have been very distinctly coloured by the recommendations of the Department, and they have been once more proved economically sound on areas entered for the crop competitions. The publicity usually given to these competitions, and the interest that centres round the methods adopted by the successful competitors, conspire to advertise the soundest principles; and crop competitions may therefore be confidently commended to any organisation the function of which is to help to popularise good farming methods.

In relation to this subject of farming competitions, the movement which has been promoted in the western wheat district is of some interest. It is a movement with unlimited possibilities in connection with increased production, and, automatically, with closer settlement, provided the Department of Agriculture is able to offer adequate assistance in the shape of personal instruction and advice, but, like other important movements, it may be traced to a small beginning.

During 1920-21, the Department co-operated with the Narromine A., P., and H. Association in conducting a series of fallowing demonstration plots, a number of farmers agreeing to cultivate and sow an area of 20 acres of wheat under the instruction and supervision of a departmental field officer. Additional interest was given to the project by the allotment of prizes for the best crops, though the intention was that the scheme should be educative rather than competitive. Twenty-seven farmers joined in the movement, but owing to adverse circumstances, only seventeen carried the demonstration through and submitted crops to the judge. Such results for the first year exceeded expectations, however, and increased entries were assured for the year 1921–22, the advantages of adopting the methods advocated being most marked, and creating widespread interest. Unfortunately, the Department found that its active co-operation could not be continued, and the scheme has been abandoned—for the time being.

In addition to these demonstration areas, the Narromine Association during 1921 conducted an open crop competition, for which twenty-seven entries were submitted to the judge. The Gilgandra and Forbes P. and A. Associations were quick to see the possibilities of crop improvement resulting from such a movement, and both Associations decided to hold competitions during 1921, the entries being twenty-five and fifteen respectively, making a total of eighty-four crops entered in competitions in the western district during this year.

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* Compiled from matter presented at the Conference of Inspectors of Agriculture, Sydney, June, 1922.

Other P. and A. Associations became interested in the results, and the promoters have developed the idea of organizing the associations of the western district for competitive purposes. The scheme is for each association to conduct a local crop competition and allot trophies, and for the winner of each local competition to be eligible for entry into the championship crop competition of the western district, for which the Royal Agricultural Society has agreed to allot trophies valued at £68 for 1922. An executive council has been formed, consisting of one delegate from each local association, and this will control all competitions. The first meeting of the council was held at Narromine on 21st March last, when conditions governing crop competitions were approved. The distribution of prizes for local competitions is left entirely to the societies themselves, but the council urges the advisability of uniformity of value in relation to the prizes offered by the different societies, and suggests that a total minimum of £20 be distributed by each local body. No crop may be entered in two local competitions, and all competitors must enter at least 1 bushel of wheat from their crop in the local agricultural show. Those competing for championship honours must also enter at least 1 bushel in the following Royal Agricultural Show. Some further details at the time of writing have yet to be arranged.

The council is also to control a number of other competitions, such as the best block of fallow land, the best crops grown on fallow, seed wheat production, and the best cropped farm. Farm management competitions are also contemplated which will take into consideration crops, stock, water supply, machinery, buildings, homestead, and the monetary return on capital invested. Commencing with the crop-growing competition referred to above, it is anticipated that the improvement in local farming methods will be so substantial as quickly to pave the way for the introduction of more advanced competitions. The associations at Narromine, Gilgandra, Dubbo, Wellington, Peak Hill, Parkes, Forbes, and Bogan Gate have expressed their intention of co-operating in the movement, and it is probable that Trundle and Condobolin will come in. It is not over-optimistic to expect that some ten associations will compete, submitting a total of over 200 crops for competition this year, the aggregate prize-money amounting to approximately £275.

The Narromine and Forbes associations have gone a step further, and have placed upon their schedules an additional competition in the shape of a combined fallow and crop competition—an idea which might well be considered by other associations. The first year the fallow land is judged on the points set out below, and in the following year the crop is judged on the scale of points set down under that heading. In such a competition prizes may be offered (1) in the first year for the best fallow, (2) in the second year for the best crops grown on the fallow, and (3) for the highest aggregate of points for fallow and crop. The particular value of such a competition is that it maintains the interest of the farmer over a long period, intensifying it as time goes on, points being given purely in the first place on the appearance of the fallow, and ultimately for the fallow as tested by the crops produced.

Only one serious difficulty faces the council—it is that of providing suitable judges. The full benefit may only be reaped from the competitions if the judges are competent—competent, that is of drawing logical conclusions from their observations and data supplied, and of making recommendations for the future guidance of competitors. Moreover, it is desirable that the crops of a given district be judged annually by the same person for a period of years, the adjudicator keeping records and basing his advice upon several years' results. Such judges must be trained men. Officers of the Field Branch of the Department are well qualified for the work, but the scale on which territory is at present allotted to them unfortunately makes it impossible for them to cope with the extra work that would be entailed by such duties. The most the district instructor can hope to accomplish is to assist in the work of organisation, advise the council, and judge, say, two local competitions. This shortage of instructors is a matter of very real importance. Competitions are only one means by which agricultural advancement could be made more rapid if the district to be covered by the field instructor were made smaller.

It is desirable that the same scale of points should be adopted throughout the State in connection with wheat-growing competitions. The following is the basis adopted by the local societies which have so far conducted such competitions. I have judged three competitions under this award, and consider it entirely satisfactory :—

AWARD FOR WHEAT-GROWING COMPETITIONS.

Trueness to type	20 points.
Freedom from disease	20 ,,
Evenness	20 ,,
Cleanliness (1st crop, 24 points ; 2nd, 25 ; 3rd, 26 ; 4th, 27 ; 5th, 28 ; 6th, 29 ; over 6th crop, 30)	30 ,,
Condition and appearance (1st crop, 24 points ; 2nd, 25 ; 3rd, 26 ; 4th, 27 ; 5th, 28 ; over 5th crop, 28)	28 ,,
Apparent yield (1 point for each bushel)	32* ,,
Total	150 ,,

* Approximate.

For fallowing competitions I would suggest the following scale of points :—

SUGGESTED AWARD FOR FALLOWING COMPETITIONS.

Moisture	30 points.
Mulch	30 ,,
Freedom from weeds	30 ,,
Consolidation	30 ,,
Cultivation	30 ,,
Total	150 ,,

Is there any limit to the scope of such competitions? They will assist, among other things, in the determination of the most suitable varieties, the best time to work the fallow, the best method of working different types of soil, the best time to sow and rate of sowing, the most suitable manures and the quantities to apply, the most profitable rotations to adopt, the best means of controlling diseases. It would surely be difficult to over-estimate the value of these and kindred contests, and the importance of placing every facility possible at the service of agricultural organizations sufficiently enterprising to interest themselves in a forward move of such importance.

THE OVERSEAS PREJUDICE AGAINST AUSTRALIAN HONEY.

ALTHOUGH, as already stated in these pages, I am of the opinion that for a season or two we could dispose of all our supply locally, if our home market for honey were improved, and particularly if the marketing of our produce were made a Federal matter, there is no doubt that we should be on the look-out for an export market, not only in Great Britain, but in other countries also. Let us endeavour to show the British people that the idea of our honey containing eucalyptus is an erroneous one, that we produce hundreds of tons of honey from such plants as clover, lucerne, thistle, &c., and that we can produce a blended honey that will be favourable to their taste. We will, no doubt have to start in a small way at first, gradually developing the trade by supplying the right class of honey, thus giving the most convincing denial possible to the wild statements concerning the eucalyptus flavour. With such goods in the hands of a suitable man on the other side, I believe we could break down a barrier which in most cases largely consists of ignorance of our products. I have made it a practice for years to introduce our honey to immigrants from Great Britain, and from my experience, and from the experience of our soldiers, I am of the firm opinion that a large percentage of British people like the flavour of our honey when a suitable blend is put before them. To show how far the ignorance concerning our honey has developed in other countries to the detriment of our trade, I quote a passage from a recent edition of "The A.B.C and X.Y.Z. on Bee Culture," by Root—a book that has a large circulation in Great Britain: "In Australia the honey of the eucalyptus is highly appreciated, but attempts to sell it in England have always ended in failure, although it ought to be useful for persons suffering from coughs and colds. Instead of the eucalyptus flavour proving to be an attraction, it proved a drawback." Mr. Root's note concerning the possible medicinal value of the product is interesting, but I cannot say that the idea of sending our honey to England labelled: "Cough Mixture" appeals to me.—W. A. GOODACRE, Senior Apiary Inspector.

Some Useful Saltbushes.

E. BREAKWELL, B.A., B.Sc.

THE saltbushes belong to the botanical order *Chenopodiaceæ*, of which the well-known Fat Hen weed is a representative. They are plants well adapted to brackish and alkaline soils, and they grow thickly in the interior. An example of the manner in which they grow in brackish soils is seen in the vegetation growing around Cook's River, among which vegetation the genus *Atriplex* is common. Saltbushes will thrive, however, on soils other than of an alkaline or brackish nature, and there are few localities in the State in which some member of this important family will not grow.

The adaptability of saltbushes to the hot and dry situations of Australia is shown in the succulent nature of the leaves, in the more or less hairy investiture, and in the deep-rooting system. The edible saltbushes practically belong to five genera, namely, *Chenopodium* (of which Fat Hen and Blue Bush are representative), *Atriplex* (such as the Old Man saltbush), *Kochia* or cottony saltbushes, *Rhagodia* (Red-berried saltbush), and *Enchylæna* (Barrier or Spiny saltbushes). These genera may be distinguished as follows:—

Section 1, Fruit succulent (provided with sap): *Rhagodia.*

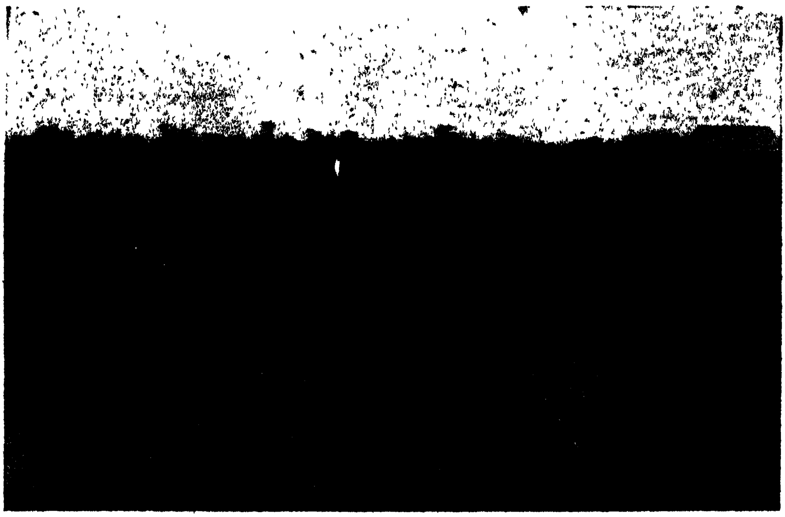
Section 2, Fruit dry: The remainder.

- A. Leaves broad: *Atriplex* and *Chenopodium.*
  - 1. Fruit in a swollen capsule: *Atriplex.*
  - 2. Fruit in an ordinary capsule: *Chenopodium.*
- B. Leaves narrow: The remainder.
  - 1. Fruit provided with a broad membranous appendage: *Kochia.*
  - 2. Fruit not provided with an appendage: *Enchylæna.*

The value of saltbushes lies particularly in their drought resistance, which stands out prominently when other grasses and herbage fail; they also grow in districts where the rainfall is extremely small, and where grasses are few in number and sparsely scattered. Although saltbushes are not appreciated to any extent where grasses and other herbage are plentiful, during drought periods they are readily and even greedily eaten by stock. The free-seeding and rapid-growing habits of the saltbushes allow them to revive quickly after heavy stocking during drought periods, a recovery that is accelerated by the fact that in normal seasons, when grasses and herbage are plentiful, altbush is not extensively eaten.

Fodder Value of Saltbush.

Some useful experiments in connection with the food value of saltbushes were carried out in this State at Coolabah Experiment Farm in 1906 and 1907. The result of these experiments gives a definite idea of the value of saltbush as a fodder, and its effect on the texture of the wool. A prominent pastoralist reported on the investigations:—" I had the sheep in a yard and had a good look at them. They have altered very much since they were taken to the farm, and have also altered since last year; the wool has grown smaller in the fibre, and shows a shorter and weaker staple without any increase in quality to make up for the loss in weight. They have not grown the frame they would running on natural pastures. I cannot understand why they have produced such a black, yolky tip, quite as good a tip as you see on sheep reared in a cooler climate. I can give no reason why sheep fed on natural grasses and herbage show a white tip inclined to be fuzzy, while these sheep, fed only on saltbush, show a good tip. Although they have not grown a really profitable fleece, nor produced the carcase of more highly-fed sheep, the experiment proves that sheep can be kept alive on saltbush alone for a considerable time, possibly for long enough to tide over a severe period of dry weather, and probably at less cost than by expensive means of artificial feeding. The experiment has also shown that saltbush can be grown at little cost—at a less cost than any other fodder—in a very dry time, and is practically drought-resistant."

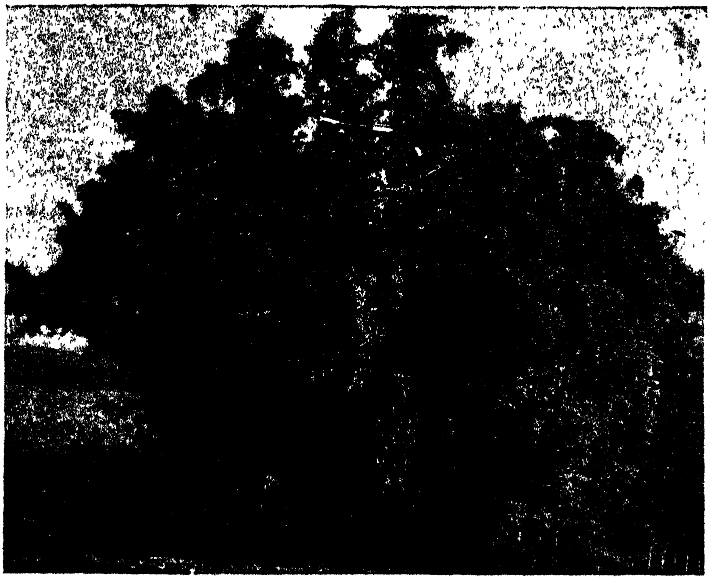


A 50-acre paddock of mixed Saltbushes.

These experiments were carried over a period of twenty-one months, during which time the sheep were entirely fed on saltbush.

Distribution of the Saltbushes.

Genus *Chenopodium*.—The most important native *Chenopodium* is *C. atriplicinum*, which is very common in the Riverina during the winter months; it is also found in some quantity on the black soils of the north-west. This plant attains a height of 3 to 4 feet; it has succulent leaves and stems; and stock fatten on it very quickly. Two native species (*C. carinatum* and *C. cristatum*) are considered bad weeds in the wheat-growing districts, particularly in the spring and summer months.

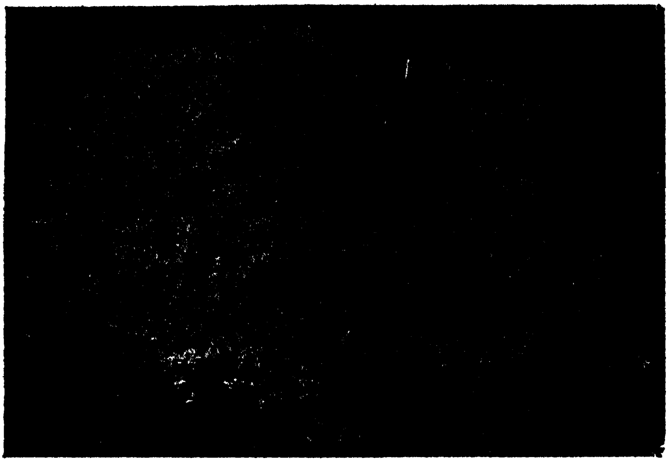


Old Man Saltbush (*Atriplex nummularia*).

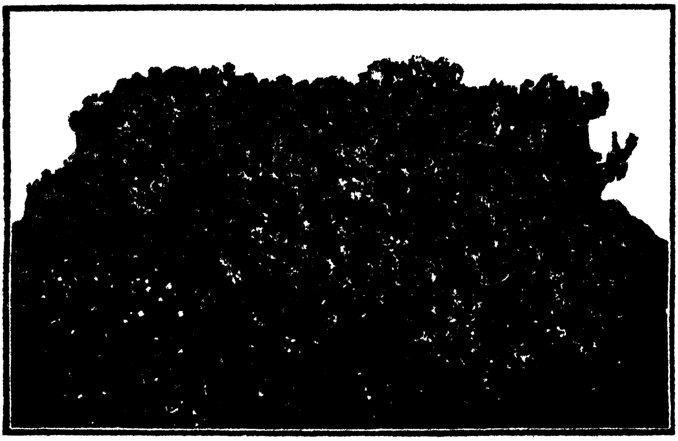
Genus *Atriplex*.—This, owing to the vigorous habit of the plants in the far west, is a very important genus. This group of saltbushes is also eminently adapted to our western slopes, but as a consequence of the wide cultivation of wheat the plants are now rare in these localities.

The most important species is *Atriplex nummularia* Lindl. (Old Man saltbush). At Nyngan this plant has produced more fodder in times of drought than any other plant grown. It grows to a height of 10 feet, and is thus better protected from the ravages of drought and over-stocking than most saltbushes. The plants are best raised from seed in a nursery bed and then transplanted If the seed is sown in early autumn the plants will be ready to transfer to their permanent position by winter. Saltbush seedlings that were planted out in this manner at Nyngan Experiment Farm grew 10 feet high in the summer of 1922, and from each plant 56 lb. of green feed was obtainable. The seedlings should be set 12 feet apart.

A. leptocarpa (Creeping saltbush) is common on the black or red soils of the west, but is very partial to the heavy black soils, and such country is called Creeping saltbush country. This species differs from other species in having long trailing runners; the leaves are narrow and the seed cylindrical. Creeping saltbush is not a particularly palatable plant. In an experiment conducted at Coonamble Experiment Farm, sheep placed in a paddock containing Creeping saltbush in abundance and, in addition, other herbs like Alternanthera, Pepper Weed, Lamb's Tongue, &c., left the saltbush until everything was eaten right out. They then ate the saltbush and maintained their condition on it



Atriplex semibaccata.



Atriplex halimoides.

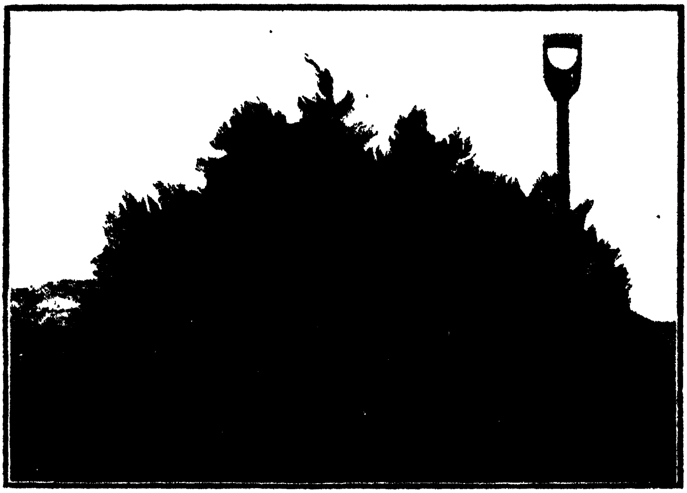
A. semibaccata is a species with a spreading and prostrate habit, and is a free-seeder. It is one of the saltbushes successfully introduced into California, and is highly spoken of. Two cuttings of 20 tons each have been obtained each season from an acre. The seed and seed-coat of this species is not unlike that of Old Man saltbush, although smaller.

Kochia villosa.

Rhagodia hastata.

A. vesicaria (sometimes called Bladder saltbush on account of the large inflated membranous appendage attached to the seed) is not common, probably because its palatability has caused it to diminish rapidly under heavy stocking. Other *Atriplex* species of economic importance are *A halimoides*, *A. angulata*, *A. campanulata*, and *A. Muelleri*.

Genus *Kochia*.—The plants of this genus are much smaller than those of the genus *Atriplex*; they have a finer leaf, are generally more hairy, and some are spiny. Many of them receive the name of Cotton Bush All are valuable as a stand-by in times of drought. The most common are *K. ciliata*, *K. villosa*, and *K. eriantha*. These species grow in abundance in the Riverina and on the red soils of the west.



Barrier Saltbush (*Enchylæna tomentosa*).

Genus *Rhagodia*.—The Rhagodias are less common in the interior than the varieties of *Atriplex*. They favour sheltered situations, such as along fences and on partly cleared scrub lands. They will also grow in situations (on the coast and tablelands, for instance) where the others will not thrive. The species perhaps best adapted to interior conditions is *R. hastata* R.Br., so called from its hastate or sword-shaped leaves. This saltbush has been proved to grow readily from cuttings, endures adverse conditions, and attains a good size in a year. Other good species are *R. nutans* and *R. linifolia*. These three species are easily distinguishable by their red succulent fruits. They are soft and succulent, and certainly palatable. *R. parabolica* is a tall species and is sometimes recommended as a hedge-plant.

Genus *Enchylæna*.—This is a genus of one species, namely *E. tomentosa*, which is very common on the black or red soil. It grows very tall, and although readily eaten by sheep, appears to stand more stocking than the other species. It is sometimes called the Barrier saltbush.

The Cultivation of Saltbushes.

The cultivation of saltbushes, like that of native grasses, is not yet carried on commercially; experiments show, however, that saltbushes will grow readily from seed, cuttings, or roots. On a big area, where turning over for cultivation is impracticable. much might be done in ploughing a few furrows here and there, and planting three or four seeds in a hole during suitable seasons. By protecting the young seedlings from stock for twelve months they should then be ready for grazing. The bulk of feed produced in normal seasons can be used as hay, which is an excellent stand-by during drought periods. Chemical analysis shows that the nutritive content of saltbushes is particularly high :—

Variety of Saltbush.	Water.	Ash.	Albuminoid.	Crude fibre.	Carbohydrates.	Ether extract.	Albuminoid Ratio.	Nutritive value.
Atriplex nummularia (cultivated)	75	5·93	4·64	3·30	8·57	·56	1 : 2·5	16·5
A. nummularia (uncultivated)	75	9·35	4·31	2·27	8·69	·38	1 : 2·2	13·9
Atriplex halimoides	75	7·65	3·88	3·36	9·59	·52	1 : 2·8	14·6
A. angulata	75	12·16	2·87	5·47	3·68	·82	1 : 1·9	8·4
Rhagodia parabolica	75	7·62	4·06	4·67	8·13	·52	1 : 2·3	13·4
R. hastata	75	4·15	9·12	2·35	8·32	1·03	1 : 1·2	19·8

Fodder reserves of saltbushes can be built up by fencing off a paddock, say, of 20 to 50 acres and planting the trees about 12 feet apart. A certain amount of cultivation is necessary between the shrubs until they become established, but this labour and expense involved is easily compensated by the return of the fodder when the dry periods set in.

SNAILS ATTACKING CITRUS TREES AND FRUIT.

A GOSFORD citrus grower wrote to the Department lately that snails were infesting the district in very large numbers, and were actually doing considerable damage to fruit and leaves of Navel oranges, the fruit being often eaten well into the pulp.

To the Entomologist this diversion of the snails was a novelty. They could be easily got out of the trees, however, by dusting the leaves and branches thoroughly with dry lime or with tobacco dust and lime. Either of these would cause the snails to drop off, and other snails could be prevented from climbing the trees by putting a band of the insecticide round the stems, or by making a ring of carbolised sawdust round the stems on the ground, but not in contact with the bark. Snails would die that tried to crawl over the carbolised sawdust, which was simply made by treating sawdust with 15 per cent. of carbolised acid.

A PRODUCERS' CO-OPERATIVE ASSOCIATION'S BOOK-KEEPING SYSTEM.

THE Citrus Fruitgrowers' Co-operative Association of New South Wales has sent the Department a brief outline of their system of keeping accounts at the Gosford packing shed, remarking in doing so that they daily receive requests for information as to their methods. They state that their system was laid down for them by a city firm of accountants. The following is a summary of the principal books used by the association:—

1. Cash book—for cash transactions (all receipts are banked and all withdrawals made by cheque)
2. Petty cash book—for petty disbursements.
3. Purchase journal—to record purchases.
4. Fruit received book—summary of members' fruit compiled from No. 5.
5. Members' fruit acknowledgments—similar to ordinary delivery book in duplicate, recording number of cases of fruit received from growers, and graded results of same (in lb.)
6. Consignees' advice notes—(in duplicate)—recording despatch of fruit to Sydney, grades, number of cases, &c. Used as basis for verification of agents' account sales.
7. Account sales book—summary of sales of fruit, entered in grades as shown on account sales, and confirmed by our despatch notes.
8. Pool book—summarising members' fruit contributions to each pool, and allocating the proceeds of sales for credit of members.
9. Growers' ledger—personal accounts recording shares in each pool, and drawings on account.
10. General and purchase ledger, general journal, &c.

KIKUYU GRASS (*Pennisetum clandestinum*) IN QUEENSLAND.

IN August of last year some roots of kikuyu grass were forwarded to Clump Point, *viâ* Innisfail, North Queensland, and from a report received recently, as well as from others that came to hand previously, it appears as if this grass is giving excellent results in the northern State.

The latest report is from Mr. L. G. Alexander, of Clump Point, and reads as follows:—"The roots of kikuyu grass have done splendidly. They were planted in new scrub soil and did not receive any special attention. Out of the samples received from the Department I managed to get most of the roots to strike, and by dividing up the runners I have, in the meantime, been able to plant out an area of approximately a quarter of an acre in size, which at the present time is covered with a mass of fine succulent feed Cattle are very fond of it, and I am sure it is a good grass for this district. I have given several lots of roots to different settlers here and they all speak well of it as being suitable to this district."—J. N. WHITTET, Agrostologist.

The Curing of the Lemon.

W. S. ARNOLD, Manager, Soldiers' Settlement, Kurrajong.*

IN my last paper on the lemon it was stated that we can grow lemons almost to perfection in this district, but often find difficulties in the way of curing the fruit, owing (among other things) to the extreme care needed in handling, the climatic difficulties, unsuitable buildings, and the period over which the fruit has to be held pending favourable prices. We must, therefore, do what we can to overcome these difficulties, first, by installing a district curing shed in conjunction with the packing shed, and second by endeavouring to make our lemon trees so bear that the period of curing is reduced. My idea is, especially with Sweet Rind, to cut off the fruit as soon as it has set after the spring bloom, and see if another blossoming can be produced almost immediately.

The lemon often flowers four or five times in a year, and we should select trees that have a tendency to make a second crop of bloom just after the main spring one from which to work our future groves. Wonderful results are obtained from judicious selection and propagation on such lines.

When to Pick.

Why is it necessary for us to cure our lemons? Because our main crop is generally colouring about May and June, just when the demand for the fruit has disappeared, save on the part of the melon and lemon jam manufacturers. Once this demand has been supplied, the market is generally very low. About the end of October the prices improve, but by this time the supply has greatly diminished, owing to the heavy windfalls of August and September, growers making no attempt, as a rule, to avert this loss by clipping and storing in May and June. July, as a rule, is too late to clip. It is in relation to this loss that a district packing and curing shed would prove its value. Lemon-growers could clip their fruit as soon as large enough, say, 2½ inches or longer (colour not being of vital importance), and bring it to the shed to be stored and cured, instead of marketing it as soon as coloured, or (if the price is not good enough, and it seldom is then) letting the crop fall and rot under the trees. The district curing shed could hold, treat, and handle the fruit through the period of low prices and until the hot weather, creating a thirst for the lemon drink again, caused prices to soar again. The small grower could not afford a suitable shed, and would possibly neither have time nor inclination for the very careful handling necessary in the process of

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*This paper was read by Mr. Arnold at a meeting of the Tennyson-Kurrajong branch of the Agricultural Bureau on 3rd July. It is particularly applicable, of course, to that district, but some of its suggestions may be of use to growers in other parts of the State. Mr. Arnold's paper on the cultivation of the lemon was published in the June *Gazette*.

curing; but the district shed, with facilities for concentrating on the particular line, would be able to cope with such growers' supplies until the time they could be sold with profit, thus giving the producer more time to devote to the working of his orchard.

Lemons for curing should be without blemish; hence we must grow clean fruit, on thornless trees if possible, on spurs close to main limbs, or where wind cannot whip the fruit about. This subject was dealt with in my last paper. Lemons, unlike oranges, should not be allowed to ripen on the trees; when they do so, the skin increases in thickness and puffiness, the fruit has inferior keeping qualities, and the quantity of juice is proportionately less. The characters requisite in a cured lemon are a thin skin with a small proportion of pith, and an abundance of juice; and to obtain these necessitates the harvesting of the fruit some weeks ahead of ripening No fixed rule can be set down as the proper time for gathering, however. Much depends upon variety, climate and locality; altitude, aspect, and soil all have their influence upon the ripening of the lemon and its keeping qualities—generally the greater the altitude the later the lemon, and the heavier the soil the better the lemon keeps. This year I noticed the Lisbon colouring ahead of the Sweet Rind. The safest rule is to cut the fruit when it is 2¼ inches long or a little longer, leaving the smaller ones to develop. This relieves the tree and gives the smaller lemons a better chance, and one can get far more uniformity in the bulk of the fruit to be handled, this last being an important point.

Handling the Crop.

Most of our lemon-growers do not appreciate the importance of cutting the lemon at the proper time. The usual practice in the Kurrajong district, and a practice to which I myself have had to plead guilty, is to get the bulk of the oranges out of the way by September, and in October to begin to harvest what is left of the lemons, putting them on the market as soon as possible to save further bother. If the best returns are to be obtained from the lemon, as from any other crop the utmost care and forethought must be practised. The fruit should be carefully *clipped* and handled, and cured for such a period as will enable the grower to profit by the better prices offering for such an article compared with those obtainable for the fresh-pulled, thick-skinned article, which will often not carry a week, and from which it is hard to extract even a small quantity of juice. The utmost care in clipping is essential, the operation being performed with clippers of the blunt-pointed type, which hold the fruit. No protruding stem must be left; if the stem is too long a second cut may be made, care being taken not to injure the "button" which fastens the stalk to the fruit, but on no account must the fruit be pulled It is also advisable not to harvest in damp weather, or when dew is on the fruit, or immediately after soaking rains. A padded basket is ideal for placing fruit in, but a bucket is always to be preferred to a bag, the mischief caused by the rolling of fruit in the latter being irreparable. All fruit should be laid gently in the packing receptacle—not thrown or dropped in. Lemons must not suffer the least bruise, for any wound forms a seed-bed for the ever-present blue mould fungus, which is fatal to the fruit's keeping quality once it finds an entrance. Like the navel shippers, I think gloves should be worn, as the finger-nail will often scratch the fruit, and do as much damage as a thorn puncture or bruise. The uninjured skin of a lemon is almost resistant to the common process of decay, there being no vulnerable point at which the fungus can make its attack.

If the grower is not prepared to take the care that is absolutely essential to success with fruit that is to be cured, he had far better apply his energies in another direction, for this market demands quality at all times. Thorn-scratched, large, or misshaped culls can be used for lemon peel, or sent along to the by-products company, for the extraction of lemon oil, calcium citrate, squash, &c. The ordinary fruit merchant will not give a payable price for green lemons, because he has not the facilities for holding and curing them; but even if he had such facilities, he would certainly want to know if the fruit had been carefully clipped and cased, knowing that they would not keep if bruised or carelessly handled.

A lot of lemon-growers give up because of their failure to cure the fruit properly and because there is no central curing shed where it can be done for them. Such growers shift the crop as soon as it is coloured and take their chance on the market, with the almost inevitable result that the lemons fail to pay their way. Clipping, storing or curing, and marketing are really as important as any stages of lemon culture, for if we fail to bring to a successful issue these phases of the business all our earlier efforts in producing the fruit will be thrown away. The four big factors in successful lemon-growing are—(1) clean, sound fruit; (2) care in clipping; (3) care in handling during storage; and (4) care after curing, and not one of these can be overlooked with impunity.

After clipping, the next operation is the removing of the lemon from the padded picking basket to the orchard box, and here again our motto must be care. There must be no pouring out of the fruit; each should be handled almost as if it were an egg and one feared to break it, and placed by hand in the box. Jolting and bumping must be avoided, too, while the fruit is being conveyed to the curing shed.

Grading and Sweating.

The next process is grading. Dark-green, silver-green and yellow should each be placed in different "sweat boxes," and these marked accordingly. The yellow lemon has not the life in it of the other grades, and if stored with them will cause trouble sooner or later, as the same condition will not suit all lemons, and the yellow should be booked for earliest disposal. Green lemons and silver-green will keep the best. If they are shapely specimens of right size they should also produce our best quality cured lemon. Green lemons have no place on the market until they have been cured, but should there ever be an urgent demand, with high values ruling for lemons, quick colouring can be forced by wetting the lemons and sweating under heavy bags to prevent the heat escaping. Some sheds have proper colouring rooms, almost air-tight, and kept at about 90 deg. Fah.

Sweating is mostly done in boxes. When the fruit is removed from the trees (and especially early in the season) the rind is charged with moisture. If the fruit is bruised or bumped when the cells of the rind are congested, it is very injurious to the keeping qualities. Sweating dispels the surplus moisture, thereby improving the condition of the lemon, while the skin becomes thinner and more pliable, and the proportion of juice is increased and is more easily extracted. If the fruit is packed fresh from the tree without sweating, the moisture exuded from the fruit causes a damp condition in the case, and conditions favourable to the development of the blue mould fungus and decay are set up. The lemon should never be allowed to sweat to such an extent that the moisture condenses on the skin, or the stem will drop out, and the fruit will lose its keeping quality. The term "sweating" is perhaps a little misleading, for what we aim at is not an accumulation of moisture, but a slight drying or wilting, by the evaporation of the excessive skin moisture. For this reason the sweating-room must be ventilated in such a way that the ventilation is under control. I remember seeing lemons sweated on the floor of a loft, in a large heap on straw instead of in boxes

The period required for the excessive moisture to go out varies from two to about four weeks. Meanwhile the lemon has coloured and ripened considerably.

In the Curing Room.

After being taken from the sweat-boxes to be stored, all lemons that show any defect or damage must be discarded; some will be spoilt, no matter how careful one is, but if the essential conditions are duly provided for, the percentage of losses will not be high. Lemon-curing is really a mild form of dehydration. Lemons have been treated in the ordinary fruit dryer, but although fruit so cured has been satisfactory from a keeping point of view, the appearance is not attractive, the rind having lost all its oil and become shrivelled and dull; whereas lemons cured as previously described are smooth, soft, and glove-like to the feel, and nice in colour.

Although free circulation of air is necessary for the curing of the lemon, the air should not be too dry, or excessive shrivelling will take place. A measure known as a hydrodeck, which registers the humidity of the air, is necessary in a large curing-shed. If more humidity is required the floor may be sprinkled with water.

The curing-room should be so constructed not only that ventilation may be controlled, but that an even temperature (not exceeding 80 deg. Fah.) may be maintained, but it must be fairly dark. A medium degree of ventilation must be aimed at; too much causes wilting, too little causes excessive sweating and decay. When curing is done on a large scale, as in a district storing shed, the shed should have a capacity of some 300 to 500 bushels, fruit of the same quality, size, and colour only being allowed in same pile. The stacks should be numbered and a complete record kept of each, namely, the time the fruit was delivered, the process through which it has gone, when it was stacked, how often it has been inspected and re-sorted, the effect of the ventilation practised, stages of colouring, how the fruit has kept, &c. Each pile should have coverings that can be rolled up or down as ventilation requires. Sometimes, after being sweated, the lemons are placed, unwrapped or cased, on straw-covered shelves in a room with an even, cool temperature, but in this event re-sorting and overhauling must be more frequent, and re-sorting is very awkward work. If cases are used for storing, re-sorting is done about every four or five weeks to remove decaying fruit. Some growers find the wrapping of the fruit a great safeguard against the spread of blue mould; others pack in dry sawdust, and this is a really good practice. About October the demand for lemons is fair, and if prices warrant it lemons that are fit may be marketed in limited quantities, supplies of the best keepers being held for November and December.*

As defence against blue mould fungus is a matter of considerable importance, certain experiments on a small scale are at present being carried out at the Settlement to see if dipping in fungicides, &c., has any appreciable influence over the keeping quality of the fruit. The comparative treatments number a dozen in all, and comprise wrapped lemons, unwrapped lemons, lemons smeared with olive oil but not wrapped, lemons smeared with olive oil and wrapped, stalks only oiled (not wrapped), stalks only varnished (not wrapped), lemons dipped in lime-water, lemons dipped in sulphur water, lemons dipped in lime-sulphur, lemons dipped in bluestone solution, lemons covered with slaked lime, and lemons covered with flowers of sulphur. In each instance the fruit was sweated for fourteen days, and after the treatments described was in every instance covered with sawdust.

Marketing.

For market the cured lemon should be graded according to quality, wrapped, and tightly packed into cases. Lemons in the ideal condition for carrying by either rail or sea are firm, but have a green stem; such lemons will carry under ventilation to almost any market if proper care has been used in packing and handling. Experiments prove that lemons are best not shipped under ice, as once unloaded they will not keep.

Fortunately, the tariff on imported lemons is so high as almost to prohibit their coming in. Why, in any case, should we import from Italy, Sicily, or California when we can grow them, and cure them too, in plenty of places in New South Wales? The requisites for success in the local lemon-growing industry are (1) eternal vigilance on the part of the grower in relation to the production, general care, and handling of the fruit, and (2) co-operation between growers to ensure sufficient bulking of the fruit to warrant the installation of the proper facilities for storing, &c. In conclusion, I might state that Gosford has set us the example by making provision for a lemon-curing shed in conjunction with their district packing-shed, and that it was very disappointing to me to see so much apathy when the district-packing shed movement was being considered here. I feel sure that necessity will yet drive us to a point at which we should have arrived by a more voluntary process, and that co-operative sheds will before very long be accomplished facts. When that day arrives the lemon industry will be in a fair way to being in a remunerative position.

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*In view of recent discussions on cellar-curing (to which Mr. Arnold does not refer), it may be interesting to remark that experiments conducted by me at Mildura, in the early days of that settlement, gave anything but satisfactory results. Shed-curing gave an excellent product.—W. J. ALLEN, Fruit Expert.

"HALF-HOURS IN THE BUSH-HOUSE."

BUSH-HOUSES of varying styles and sizes are to be found alongside many hundreds of dwellings in Australia, but so far as we know no book devoted to the subject has yet been presented to Australian readers, and the brochure of 160 pages written by Mr. A. E. Cole (whose pen name "Bouquet" will commend him to many who do not know him personally) is therefore a welcome one.

Lovers of horticulture are increasing in numbers, and there are those who are finding that many flowering and foliage plants that require much care and attention to do any good in the open garden will thrive in the bush-house, yielding feasts of beauty and engaging both interest and pleasure. This little book deals with the construction of the bush-house itself, tells all about the potting and care of tubers, ferns, palms, foliage plants, creepers, ornamental grasses, and orchids, describes the making of baskets and many other useful devices, and devotes a chapter to small hot-houses.

The subject is handled in a readable and essentially practical fashion. (Published by Angus and Robertson, Ltd., Sydney).

A DISEASED BANANA CORM.

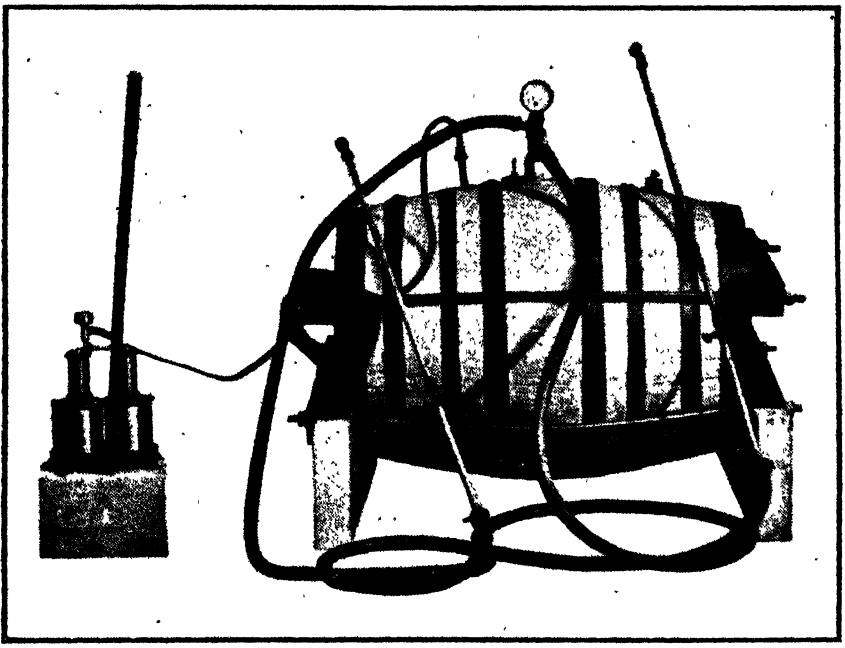
A MURWILLUMBAH correspondent forwarded some diseased banana corms. In the previous few months he had noticed several plants gradually wilt and die, and had observed as he dug them out that the conditions were the same in each case.

The Biologist stated, in reply, that where a banana corm has been planted immediately over the root of one of the soft-wood trees left in the ground when the scrub was felled, the fungi that caused the decay of the root will frequently, when nourishment there is exhausted, enter the banana corm and destroy it. In these cases the banana plant withers completely and dies, differing in that respect from plants affected with bunchy top, which seldom wither and die. In plants infested as stated, the white mycelium of the fungus can usually be seen in the cellular spaces of the banana plant when the stem is cut across. No remedy can be applied to an infected plant, but in replanting care should be taken to place the corm away from any old tree root, which should be located by previously probing with a crowbar.

Spraying for Black Spot of the Vine.

H. L. MANUEL, Viticultural Expert.

NEARLY every vine-grower is familiar with the operation known as "swabbing." In small vineyards it is carried out by hand, a swab or brush being quite effectively used for the application of the solution of sulphuric acid, but where a large number of vines have to be treated that is a slow and tedious method, and the winter treatment is often neglected by growers in consequence. The question therefore presents itself whether a spraying machine is available that will resist the action of the sulphuric acid and at the same time reduce the time and labour involved in swabbing.



A Spray Pump that will apply Sulphuric Acid in Solution

Two types of machines are available for this purpose. One is made in the form of an ordinary knapsack sprayer, but lined with lead to resist the action of the acid, and the other is a larger type somewhat similar to an ordinary barrel spray pump. The latter is manufactured by a Melbourne firm, and is understood to be used a good deal on the Mildura irrigation areas. It is specially designed for the application of sulphuric acid solution, for instead of the ordinary suction pump through which the solution actually passes, as in other machines, this sprayer is fitted with an air pump which creates an air pressure inside the barrel, forcing the acid solution through the nozzles in the form of a spray. The barrel is only partly filled with spray solution, the rest of the space in the chamber being reserved for the compressed air. Either a sledge or a wheel carriage can be used for moving it about.

One objection sometimes raised to the knapsack sprayer is the likelihood of sulphuric acid getting on one's clothes, but if reasonable precaution is taken very little trouble should be experienced in this respect. It is well for the workman to wear very old clothes, and he will find a wheat bag placed across his shoulders a means of protection.

To preserve the life of the abovementioned machines every care should be taken to cleanse them thoroughly after use.

The formula recommended by the Department which includes sulphate of iron cannot be used in these machines, being too concentrated, but one can resort without any detriment to the straight out sulphuric acid mixture.

"COWS, COW-HOUSES, AND MILK."

"THE objects of writing this book are to improve the conditions under which milch cows are kept, to increase the supply of milk, to spread knowledge as to how its clean condition can be insured, and to give the cow-keeper and dairyman reasoned information on the important points to be observed as regards cows and the liquid they furnish."

That, according to the preface, is the programme the author of this book had before him, and if at first glance it appears somewhat ambitious, it must be admitted that its 132 pages are crammed full of matter of a practical kind presented in straightforward, useful fashion.

The breeds of cattle now chiefly in favour are the product of a process of evolution the later stages of which have been accomplished much more rapidly than the earlier ones, and this book contains useful chapters on breeds and breeding. As the demand for milk increases—especially as population tends to centralise—the problem of milk production becomes increasingly important. The peculiar liability of milk to rapid and injurious changes makes essential the most scrupulous cleanliness. The day has gone when milk was handled with easy confidence by the family that fed and milked the cow and drank her product at once, and in its place we have a huge highly-developed organisation by which milk is drawn and consumed by persons who never see one another. The care that is necessary under such conditions is expressed in the laws and regulations that are now to be found in every civilised country.

It is the instruction of producer, consumer, and purveyor that this little book aims at, and it therefore belongs to a class that should find a place on every bookshelf. The author is Mr. G. Mayall, M.R.C.V.S., who has already published several other well-known books on livestock subjects. The present one is a reprint of a second edition. (Published by Baillière, Tindall, & Cox, London).

The Standard Breeds of Poultry.

CAN UTILITY AND BEAUTY BE OBTAINED IN ONE BIRD?

C. A. HOUSE, Editor, *Poultry World*, England.*

BEFORE I touch my subject, may I say how highly I appreciate the honor paid to myself by the authorities of Hawkesbury College in asking me to read a paper at their annual conference. Last year Mr. Potts, your late Principal, gave an address at the Poultry conference at the Harper-Adams College. That is a three days' national Conference which year by year attracts some of the greatest men in the poultry industry of Great Britain. It has, of late, become international in character, having been addressed by eminent professors and breeders from the continents of America, Africa, and Australia. Last August Mr. Potts placed English breeders under great indebtedness to Australia by the most educational and interesting address which he delivered. That indebtedness I hope in some measure to cancel to-day.

This subject is one which affords plenty of room for thought, and I have been led to take it as the theme of my paper to-day, because during the three months that I have spent in this beautiful land of yours I have come to the conclusion that in Australia, as in England and some parts of the continent of Europe, there is a great gulf between the breeders of utility stock and those who breed exhibition or standard birds. That, however, is not immoveable and fixed—it is not one that cannot be bridged.

In France and Belgium the utilitarian breeder and the exhibition breeder are not far apart; they work hand in hand together—indeed, they may be said to be the same people. The native races of fowls in those countries have been made in the districts after which they are named, and have, in most cases, been developed on certain definite lines. As an illustration, the birds of Bresse belong to one of the laying breeds; the bird named after Malines is a table bird. In the former district eggs is the end and aim of the poultry-breeder; in the latter it is the most delicate table properties. In each of these breeds the type is maintained, beauty valued, and the utilitarian properties not endangered or sacrificed by excesses in any one direction. In Denmark and Sweden the same. There the Buff and Brown Leghorns are kept true to type, even while eggs is the chief object in view.

Dutch breeders are just now paying greater attention than ever to the production of large brown eggs for the English market, and during last winter the eggs from the Barneveld district have been selling in the London market at 3d. per dozen more than the eggs of either Denmark or England. A club has recently been formed, and its first show was held at Utrecht in December last. A standard has been drawn up, and that standard has been so drawn that no encouragement is given to excesses in outward appearance. The Barnevelder is a laying breed, and the men of the district in which it originated are determined it shall maintain its utilitarian value.

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*Paper read at the Annual Conference of Poultry Breeders at Hawkesbury Agricultural College, 24th June, 1922.

It has been my pleasure to watch the development of the Barnevelder since it was first shown, about eight or nine years ago. The men most interested have fought against a standard being formed, because they felt that it might lead to the breed being judged for its beauty and not for its usefulness. They have, however, come to the conclusion that if the breed is to be maintained in its purity it must be standardised. Hence the formation of the Barnevelder Club and the drawing up of a standard. The reason why that standard has been drawn up is to preserve the purity of the race and to prevent it from being "mongrelised." They have realised that unless there is a standard to which breeders should work the breed may lose its type and degenerate, as have some other breeds. They have discovered that the man who makes egg-production the alpha and omega of his poultry-keeping is equally as great an enemy to a breed as the man who makes a fetish of colour, markings, or head properties.

This brings me to the reason why of my paper. I have seen the birds in the egg-laying competitions of three of your States—Western Australia, Victoria, and New South Wales. In each of those competitions I have seen birds which in my opinion were not representative of the breed after which they were named. I have seen White Leghorns which in head properties, shape, and size of body were far from the standard. Black Orpington is a truly British breed, but some of your Australian Black Orpingtons—well they are black certainly, and as they lay eggs one cannot deny that they are black fowls, and utility fowls. But what of the type? I do not want to say unkind things, but it certainly seems to me that some Australian Black Orpington pullets of the past must have wandered out into some of the luxuriant Chinese gardens which I have seen since I landed in Australia, and that there instead of having a good feed of green food, which would have done them good service, they got flirting with some Chinese cockerels and the result is seen in what I may, to coin a word, call the "Chin-Orps" of your poultry-yards and laying competitions. Orpingtons they certainly are not. The cross is shown not only in their shape, but also in those tell-tale feathered legs and feet.

This is a serious matter, and one that calls for a drastic remedy; but before I go any further I would like to say that New South Wales is not the biggest sinner in Australasia. I say this not only to save myself from the bricks that some of you may contemplate hurling at my head, but because, thanks to your very practical expert, Mr. James Hadlington, you have endeavoured to improve the birds in your studs by rigorously rejecting those that have not in some measure approximated to the recognised standards of the breeds to which they are supposed to belong.

Credit, great credit, is due to you for what has been done in this direction But there is still room for improvement, and in this, I believe your Government expert will agree with me. His ideal, I have gathered from conversations we have had, is the same as my own. There is no reason whatever why the bird of the show pen should not also be the bird of the laying competition.

In England I have used both pen and voice in advocating the unison of utility and beauty. I would not have you believe that in England that we are any better than you in Australia. The winner of one of our single bird tests a year or two ago was of such a character that I asked through the *Poultry World*—how was one to classify a bird which had a Leghorn body, a Wyandotte head, and a Hamburgh comb? The reason why I asked that question was because, although competing as a Wyandotte, I could, in its outward form, see traces of the three breeds. Thus you will perceive that not all the flowers in our English gardens are lovely.

On the other hand, we have breeders who can and do take from the one breeding pens birds which can win in the open classes of our shows, whilst their sisters can top the bill in the egg-laying competition, and others of their brothers and sisters can win in utility show classes, and also in classes provided for dead table-poultry.

Here I would like to emphasise further what I have already stated elsewhere, and that is the approach which some of your utility breeders are making towards the standard. The birds—at least the majority—exhibited in the utility classes at the Royal Agricultural and other shows which I have visited were in not a few instances quite equal to those shown in the open classes, but if I am to be an honest critic I must also say there were others that were not.

In England we have had some difficulty in persuading the Inland Revenue authorities that poultry were part and parcel of agriculture, and in fighting against unfair taxation of poultry-farms we have had to take legal action. Our case was presented to one of the leading K.C.'s—a man whom you Australians would respect, because you like open speech. His first comment was, "If poultry are not agriculture, what the devil are they?" You, I am sure, will agree with that K.C.

That being so I would ask: why then should the poultry-farmer be behind the general farmer? The latter takes into the show ring the bull that sires his dairy cows, or his beef steers and heifers. He knows that a good bull—one possessing the breed characteristics of the family to which he belongs—is the one that will produce progeny with good milking or weight records. He knows also that any calves or steers that he sends to market will fetch a penny or twopence more per pound more, than those sired by any old mongrelised bull. The best milking cows do not come from Shorthorns, Guernseys, or Jerseys that are unrecognisable when the standard points are looked for. If the general farmer values breed and characteristics in his in his utility stock—if his show and utility animals all come from one and the same source, as they undoubtedly do—why should not the poultry-farmer follow on the same lines? They are both agriculture.

There is no reason whatever why the poultry-farmer—the man who breeds for the egg basket or the table—should not be just as anxious and just as careful about the outward beauty of his birds as is the general farmer of the handsome proportion and fine skin of his bulls and cows.

Can utility and beauty be combined? Undoubtedly. Fifty years ago, when I was a boy at home, my father kept Light Brahmas. He kept them not only for their beauty, but for their egg-production. In those days they were the best winter layers known to the English poultry keeper. They had not then so much feather as now, but they were just as beautiful, and laid far more eggs than they do to-day. The late Mr. Lewis Wright had Light Brahmas forty years ago that could turn out their 200 eggs in twelve months. The Light Brahma of to-day could not do it.

Breeders in England and Australia have both got away from the breed standards of perfection. The exhibiting fanciers have in a number of breeds been breeding for one or two points, points which to the educated eye may have made for beauty, but which in no sense added to the usefulness of the breed. The birds have attained great value because of the prizes which they could win, and it paid better to breed birds which for show purposes would bring in anything from £20 to £50 each than it did to breed birds for eggs only Thus have the utilitarian properties been lost.

Now for the other side of the picture. The utilitarian has scoffed at the show man, but he has done more to wreck the different breeds than has the exhibition breeder. He has lost head properties, colour, size, and type, and has, in many cases, been breeding birds which certainly were not standard-bred birds.

How is this to be remedied? I have one principal suggestion to make. The managers of all egg-laying competitions should insist upon all birds entered in such competitions approximating to the characteristics of such breeds. You have done it at Hawkesbury, and the result of your good work is to be seen in the greater uniformity of the birds competing in your competitions, and in the wonderful improvement which has been wrought in the laying stocks of New South Wales. The work has been begun—there is yet room for further advance. More rigorous still must be the rejection of birds which do not come near to the standard. Breeders must be made to realise that the standard bird is the bird that will keep up the stamina, fecundity, and egg-production of the different breeds. If egg-production and egg-production only is to be the slogan, then the time will surely come when, by the loss of stamina owing to excessive production, some stocks will cease to exist. We want eggs, more and more of them, but if we sacrifice all breed characteristics we shall soon sacrifice the birds as well.

On the other hand, our fanciers—the breeders of exhibition stock—must be made to understand that by breeding for excessive outward properties they are inflicting equally serious injury upon the poultry industry, and that there is a point beyond which it does not pay to go. This is the crux of the whole question.

Breeders in England have become alarmed at the high rate of mortality amongst the fowls of to-day. Arguments have been advanced showing that over-strained pullets and hens make bad breeding-stock. We get much stronger chicks from birds that lay every other day than from those that are putting up high records. Moreover, the size of the egg determines to a great extent the vitality of the chicks. The eggs of a prolific layer tend towards smallness. The idea of treating the hen merely as "a machine to turn out eggs" is wrong.

There is always danger in going to extremes. Every reasonable poultry keeper wants the productivity of the hen to be developed to the utmost extent, but not at the expense of her stamina. The time has arrived for a different policy to be pursued in the utility poultry world, otherwise the laying tests, which in the past have proved a blessing, may become a curse.

If breeders of the two classes will only set about honestly trying to find a common practice they will do it During the past four years breeders of exhibition White Leghorns have improved their birds and brought them nearer to the standard. This has been done by breeding birds shorter in leg smaller and finer in quality of comb, more kid-like in quality of lobe, and' neater and finer in wattle. These are all properties which the utilitarians value, and if they in turn will increase the size of their birds, and improve the shape of their combs, both parties will be getting nearer to the standard than they are at the present time. Exhibition and utility breeders are at one as to the value of a good, bold, bright eye, and the shape of the body of the Leghorn, so that there is really very little to be done to give us a standard bird—one that shall be able to win in the exhibition pen and also fill the egg basket.

Extremes meet. We jump from white to black. Next to the White Leghorn the Black Orpington is the most popular breed in Australia. I say Black Orpington, but it is really a misnomer to so style many of the birds so described. Many I have seen are half-bred Langshan-Minorcas. They have the head of the Langshan—the length and carriage of neck and the feathered legs and toes of the Chinese production - and they have not the width of front that should be seen in the Orpington—to say nothing about the white in lobes, and the long backs and tails of the Minorcas.

Quite recently I had the pleasure of visiting a number of poultry farms with Mr. Hadlington, and at one we both agreed in advising the owner not only to cull the Langshan-looking members of his flock, but as soon as possible to clear out the whole lot and purchase a fresh stock from a stud which has type. Many of the Orpington men have a longer furrow to plough than the Leghorn men, though not all of them. In some of your New South Wales farms I have seen many Black Orpingtons that were really very typical, and failed only in being a trifle small or a bit long in back. So far as the Black Orpingtons are concerned, it seems to me all that is needed is for the major portion of the utility men to study shape of comb and body a little more than they have done, and for the exhibition men to rid their stocks of the abnormal quantity of fluff which they possess. Heavy fluff and heavy egg-production never yet walked together. Very little is needed to bring the exhibition Black Orpington back to the standard which says it shall be close feathered. This was shown by the splendid black cockerel which won at the recent Sydney show of the Poultry and Pigeon Association of New South Wales.

The utility men have a longer road to travel. Careful selection however, will do it, as is shown by the splendid work of Mr. Mulliner's pullet at the last Hawkesbury laying competition, and also by the very fine stocks of birds kept on the Hawkesbury College farm and on the Government farm at Grantham. The typical appearance of these stocks I am told, is due to the persistent and consistent efforts of Mr. Hadlington to secure as layers birds which should be entitled to the appellation of standard birds.

Rhode Island Reds are a breed in which there is a falling away in colour on the part of the utility birds. So far as shape and size is concerned there is not much to complain about, except that some are not quite so long in body as they should be. From observation both here and in England, and also on the Continent of Europe, the exhibition and utility Rhode Island Red breeders are not very far apart, as the exhibition men have not yet bred for points which are opposed to utility value, and they do look upon their birds as belonging to a utilitarian breed, and they seek to emphasise that fact.

There is no reason whatever why our utility birds should not be handsome, or why they should not conform to the standard of perfection. I am inclined to think that after all is said and done that there is not much fault to find with the standards. The fault lies rather with those breeders on the one side who ignore standard properties, and those on the other side who breed some of them to excess. But more than all should we blame the judges at our shows. In their hands lies the remedy. If they would only give prizes to the best all-round birds in preference to those which excel in, or have in excess, some particular property, we should see, quickly, an improvement, not in one, but in all our breeds.

In New Zealand the judges are instructed as to their duties. The Book of Standards says—"Judges must consider carefully each and every section of the specimen, and not allow colour alone, or a specimen excelling in head-points, to influence their decisions The vital importance of typical shape of the breed that is being adjudicated upon is to be borne constantly in mind, at the same time giving due consideration to colour in all sections, including under-colour. In determining size, the judge shall decide by comparing the specimens in competitions with due regard to weight in all breeds and varieties as specified by the standard. When a bird fails to attain to, or in case it exceeds, the size proportionate with the type or shape, it must be discounted quite severely. It is desirable that the judge recognise and reward those specimens that come nearest to the ideal in shape, size, and weight, still giving the important and vital matter of correct plumage full credit. A specimen in any breed falling more than 1 lb. below weight or weighing more than 1½ lbs. overweight shall be passed." May the day soon dawn when breeders and judges alike shall acknowledge that true beauty and perfection is seen only in those birds in which there are no abnormalities, but, that in perfect symmetry and true proportion the ideal is to be found!

The Domestic Rats.

WITH SUGGESTIONS FOR THEIR CONTROL IN FIELD AND BARN.

THE BROWN RAT (*Rattus norvegicus*) AND THE BLACK RAT (*Rattus rattus.*)

[Concluded from page 505.]

W. W. FROGGATT, F.L.S., Government Entomologist.

Fumigation for Rats.

A number of fumigants have been used in dealing with rabbits in their burrows in the country, and also in attacking the rats in ships, warehouses, basements, barns, stacks, and outhouses. In all places where gases and poison fumes can be safely used, fumigation is one of the most effective methods of destroying all kinds of pests.

Bisulphide of carbon, a heavy gas which sinks downward, is most effective in burrows in the ground, or in haystacks in the country, where the volatile liquid can be poured upon a piece of bagging and pushed into the burrow, or poked up holes in the stacks and closed up on the outside. The heavy fumes kill all the life that cannot get to the open air. This fumigant is also sometimes used by the city authorities to destroy rats in the sewers, and also in rat-infested ships; but on account of its inflammable nature when it comes in contact with a naked light, other heavy gases, such as carbon monoxide or sulphur dioxide, are more commonly used.

There is no danger to the operator from inhaling the fumes of bisulphide of carbon in the open, as there is with some other gases; but he must be careful not to allow any matches, pipes, candles, or naked lights to come in contact with the fluid or fumes, for they are very inflammable. A strong "cabbage-water" smell will warn the operator of the presence of fumes.

Carbon monoxide is rather dangerous. It gives no notice of its presence, and as the confined fumes are very deadly to human life accidents sometimes happen. It is chiefly used in the holds of rat-infested ships.

Sulphur dioxide, generated from burning sulphur, is the fumigant chiefly used in fumigating sewers and the holds of ships.

Hydrocyanic acid gas is generated by mixing cyanide of potassium with a combination of water and sulphuric acid. It is a very light and volatile gas, with great penetrative power. It is much used by entomologists on account of its power to penetrate through every crack and crevice, clearing houses of cockroaches, bugs, or insects that feed upon stored food products. The writer, while using it in Sydney warehouses, has frequently had practical evidence of its rapid effect on rats, and every rat enclosed in a fairly air-tight room properly charged with hydrocyanic acid gas is killed in a few moments, and usually dies in the open. Of course, the penetrative gas will also kill some in the roof, or those behind wainscots, but most of the dead rats can be easily collected and destroyed.

The writer considers that fumigation with hydrocyanic acid gas, under careful supervision, is one of the most effective, cheap, and rapid methods of destroying rats and mice in houses, and in any places which can be made reasonably air-tight so that the fumes can be confined for a few hours. The method is simple. The formula for every 100 cubic feet of space is as follows :—

3 oz. of water.
1 ,, sulphuric acid.
1 ,, cyanide of potassium.

Perfectly clean tins or earthenware jars or basins must be used as containers. These containers are placed at intervals in a room which has previously had all openings covered by pasting brown paper over them or plugged with bagging or other material. The operator will go round and measure the exact amount of water required for the charge and put it in the container. The cyanide, which has been broken up into small cubes, is then weighed, and the exact charge for each container is placed in a thin paper bag and placed beside the container. The operator then goes round with his measure and a jar of sulphuric acid, pouring the exact amount of acid into each container, taking care to pour it in slowly so that it shall not splash up on the hands and face, as it burns the skin. If by chance it does splash on the hands, place the hand at once in a tub of water and wash it off. As soon as all the containers are charged with the water and acid solution, the operator drops each package of cyanide into the container near which it is lying, starting at the one furthest from the door. The paper bag retards the development of the gas until he has time to complete the lot, leave the room, and lock the place up. The room must be locked up from the outside and left for the night. Next morning nearly all the fumes will have escaped from the building, and the doors and windows can be opened and the few remaining traces of the gas blown out. It is advisable to leave a window or two unlatched when they are pasted up inside, so that they can be pushed open. There is little or no danger for a careful man in fumigating any ordinary building.

In a cellar or basement where it might be difficult for the operator to get out quickly after the container is charged with acid, the bag containing the cyanide can be hung over the container by a string leading out through a hole in the door; the string can be cut or released as soon as the door is shut and the hole in the door then plugged up.

Cyanide of potassium has also been used like arsenic for making "poison water baits." The water to which the rats, mice, or rabbits are accustomed to come is shut off, and a fresh supply is set out near where they congregate. In two or three days they will have become accustomed to the new water supply, and then it can be all changed for cyanide water at the rate of 1 oz. for each gallon of water. This solution will retain its deadly qualities for about two days without deterioration, and be poisonous to a lesser degree for a longer period. The water can be placed in shallow pans or tins fixed in the ground. When available, lengths of tin guttering a few feet in length, soldered up at each end and sunk in a furrow in the ground to keep them firm, will make ideal containers, and when done with they can be taken up and stored away for further use.

Infective Virus or other Micro-organisms.

It is well known that all rodents from time to time are carried off in large numbers by some virulent disease, particularly when the animals have increased in numbers beyond the normal limit. Micro-organisms that develop in the lungs, liver, or other organs, in the tissue of the body, or on the surface of the skin, such as hydatids, coccidiosis, and favus, all act in this direction. Some of our landholders have suggested that the Government should take this question up, and ask the Director of the Pasteur Institute to send a trained man to Australia to carry out investigations along this line.

The use of bacterial diseases for the destruction of rodents has been carefully studied, and many laboratory and field experiments have been carried out in Europe and America. Dr. Loeffer used *Bacillus typhemurium* in Thessaly to destroy the field mice in 1892–93, and claimed a certain amount of success, and other experiments were carried out in Russia.

In 1904 Danysz virus was used in France and very satisfactory results were recorded, but generally speaking the artificial production and use of virus for rat and mice extermination has not been an unqualified success.

Hinton, in the British Museum Bulletin on rats and mice (Technical Series No. 8, 1920), says: "The disease communicated usually propagates itself from rat to rat very slowly, and, what is worse, less than fatal doses render rats immune. The harmlessness claimed for all, towards animals other than rats or mice is, at least in many cases, open to question. Although bacteriology may furnish us any day with an efficient means of destroying rats at will, it cannot be said to have done so yet. Not one of the many preparations sold can be recommended as a safe and thoroughly reliable means of destruction."

While pointing out the unreliability of rat viruses as used in the United States, Lantz (House Rats and Mice, United States Farmers' Bulletin 396) says: "The chief defects to be overcome before the cultures can be recommended for general use are:—

"1. The virulence is not great enough to kill a sufficiently high percentage of rats that eat food containing micro-organisms.

"2. The virulence decreases with the age of the cultures. They deteriorate in warm weather and in bright sunlight.

"3. The diseases resulting from the micro-organisms are not contagious, and do not spread by contact of diseased with healthy animals.

"4. The comparative cost of the cultures is too great for general use. Since they have no advantages over the common poisons, except that they are usually harmless to man and other animals, they should be equally cheap; but their actual cost is much greater. Moreover, considering the skill and care necessary in their preparation, it is doubtful if the cost can be greatly reduced."

Rat Fleas.

Dr. Ferguson informs me that three fleas are common upon the bodies of those rats captured in the city of Sydney and examined at the Board of Health in connection with the plague precautions:—(1) The common European rat flea (*Ceratopsyllus fasciatus*, Box) which has been introduced into Australia from Europe with its host the rat; (2) the tropical or Indian rat flea (*Xenopsylla chcopis*, Roll) which has come to Australia with rats from the East; and (3) the mouse flea (*Chenopsylla musculi*) which ranges with its ordinary host, the domestic mouse (*Mus musculi*), from Europe and Australia, but which is also found upon rats. Other closely allied rat fleas that are not recorded in Australia are the Asiatic rat flea (*Ceratopsyllus asinus* Roth), which takes the place of our *C. fasciatus* in Japan and Eastern China, and the Javanese rat flea (*Pygiopsylla analæ*), which chiefly lives upon rats in the plantations and is capable of carrying plague germs. Another African flea has been named *Xenopsylla scopulifor;* it is allied to *X. cheopis*, and is found upon rats in Eastern Africa. The chicken flea or sticktight flea (*Echidnophaga gallinaceus*, West) is the chicken flea found in many parts of the world; it is very common in the United States where it has been given the popular name of "sticktight flea," because it is one of the species that buries its sucking mouth in the skin of the chicken, and, unlike the free roaming fleas, remains attached to its host. The generic name is rather unfortunate, but it was originally created by Skuse for a species found upon the skin of our *Echidna*, and when the fleas were reclassified the sticktight flea came naturally into this genus. Personally I have never seen this flea upon chickens in New South Wales, but Dr. Ferguson has recorded it as common in Western Australia. Another closely allied species (*Echidnophaga myrmecobii*, Rothsch), identified by Dr. Ferguson, is very common at times in the ears of rabbits. Bishop says that in the United States the chicken flea attacks wild birds in addition to domestic species, and it has been taken on rats in numbers. It bites man with avidity. Two other species described by Baker (*Ceratopsyllus cutus* and *Hoplopsyllus anomalus*) are found upon the ground squirrels in the eastern United States. Bishop says: "They have been shown capable of transmitting plague, and both feed readily on man, and will feed on rats."

While rat fleas are true plague fleas, other fleas, such as the common house flea (*Pulex irritans*), and the cat and dog fleas (*Ctonocephalus canis* and *Ct. felis*), which are considered by some authorities to be the same species, are very serious pests in all parts of the world. Sometimes under suitable conditions for their development they appear in enormous numbers. Domestic cats in the house, and dogs which get under a house and sleep in the dry dust in such sheltered places, frequently become the generators of large numbers of fleas. Countless numbers of eggs are dropped in the dust under the house or upon mats or sleeping corners of domestic cats, and these places become ideal breeding grounds for fleas.

The tiny little eggs, like white crystal spheres, produce tiny white legless maggots, with a few scattered stiff hairs on the anal segments. These crawl into dusty cracks and crevices in the floors; they live upon dust, excrement, and dried blood. When full grown they form a regular cocoon in which they pupate, and from this cocoon the adult flea emerges.

Fleas are picked up in all sorts of public places—trams, trains, warehouses, churches, and in the streets—and are thence easily carried into perfectly clean and well-kept houses. When they obtain a footing in a neglected house where dust is allowed to accumulate or where cats and dogs can wander about, they may become a very serious pest.

Troubled with rats in a public building near the water front, the writer allowed the attendant to introduce two cats, and they were permanently located upon the same floor. When the warm weather came fleas appeared in all the rooms in thousands. They were traced to one room where there were carpets and mats upon the floor, and where the cats had taken up their abode in their leisure hours. The cats were got rid of, and a vigorous campaign was carried out against the fleas with kerosene sprays. Within a fortnight the building was clear of fleas once more.

THE PRUNING AND CARE OF THE LOGANBERRY.

THE loganberry should be trained on a wire trellis. The shoots which have cropped are removed during the winter, leaving the new shoots which have come during the previous growing season to produce the coming crop. The plants should be kept well cultivated, and in the poorer soils should receive liberal applications of stable manure, if available, or of blood and bone. Though hardy, loganberry plants will not produce a continuous crop unless they receive regular rains or applications of water when cropping. During dry seasons or where the rainfall is light during the summer, liberal applications of water will be of benefit. Is is advisable to plant the berries in a well sheltered position. It has been found that if hot northerly winds occur during the ripening period the fruit is apt to shrivel unless the ground is wel saturated.—W. J. ALLEN.

August Work in the Apairy.

W. A GOODACRE, Senior Apiary Inspector.

DURING the very early part of the season (generally about August) the chief concern of the bee-farmer is to know that every colony of bees has an ample supply of stores. The carrying out of progressive work is left until later on, when the colonies will be in a more prosperous condition, and the weather less changeable. Too often, when the bees first show signs of activity, beginners make a start at what is, they consider, to be progressive work, and carry out operations which should not have been attempted for another couple of months. This interest and eagerness is a good sign, but to be able to refrain from interfering too early with the bees is a desirable feature that should also be cultivated.

Probably the chief object of one who compiles literature is to give the reader ideas that will enable him to work out such problems as he is likely to meet with. It cannot be justly described as regards the conditions obtaining in any particular bee-farm, individual colony, or certain locality. Let us discuss a few problems, and it will readily be seen how a knowledge of bee culture will assist.

A beginner can, no doubt, rear queen bees for the purpose of Italianising his colonies very early in the season, but other things have to be considered. What is the use of rearing queens if there are no drones flying to mate with them? They would all be drone layers. What, too, is the use of rearing queens if the weather conditions are not settled and warm enough to give a reasonable chance for the young queens to take the wedding flight, even if a few drones are flying? Far better to wait a while, and rear queens under better and surer conditions with less risk.

What, again, is the use of going in for artificial increase before the colonies are populous, and in a progressive state as regards brood raising? Where can queens be purchased in the early part of the season? Or how can one rear good queens for the young colonies so early? Why divide a colony at a time when all its strength is necessary to overcome the severe early spring conditions? In the cooler climates, in fact fairly generally at this period, the bees will still to some extent be clustered, and every time that cluster is disturbed extra energy on the part of the bees to raise the temperature again is necessary. Why unduly disturb them so early in the season, and shorten their lives at a period when all their vitality is required?

What has been discussed gives some idea as to how a broad view of all anticipated early manipulations should be taken.

While admitting that there are some early and warm climates where attention could be given to bees during August, the activity of the bees, the condition of the weather, and a knowledge of the climatic conditions obtaining in that particular locality, should clearly indicate a time when it would be quite safe to carry out serious colony manipulations. In localities where bees make a start for their season's work during August, the practical man will generally only take note of the activity of the bees at the entrance. If there is any doubt as regards a shortage of stores, or whether the population of the colony is seriously reduced, a glance under the cover will be sufficient to satisfy him without any serious disturbance of the cluster of bees. The principal work of preparation for August, as regards stores and for the comfort of the bees, should have been attended to during the autumn.

If a colony is found short of stores at any time it is advisable to give them frames of honey from other healthy hives, or to feed the bees on sugar syrup. The question of stores for the colonies, even where a good quantity was left for the bees, will have to be given serious consideration later on, because when intense brood-rearing is being carried on stores disappear very rapidly, and even a shortage of stores then may have serious results.

I believe that a shortage of stores for spring stimulation causes as much loss in bees in this State as disease.

A BEE-FARMER'S ENEMY—THE RED-BACKED SPIDER.

THE red-backed spider is fairly well-known to all. Children in most cases understand that the red stripe round its marble-shaped body is a danger signal, and that care should be taken in handling anything the spiders are likely to be on. To the bee-farmer, these spiders are a dual trouble. They are often concealed in the hand-holds, or in odd corners, and care has to be exercised when the hives are being manipulated. Secondly, and probably the most serious trouble, is that the spiders destroy bees. I have observed the true red-backed spider, which had its web in the hand-hold of a hive, secure two bees in the one operation. A second after the bees had touched the adhesive web the spider had them completely covered with webbing. So completely were the bees covered that it was impossibie to extract them so that they would be of any use afterwards.

Specimens were forwarded to the Government Entomologist (Mr. W. W. Froggatt), from whom the following reply was received :—The two specimens you sent are the well-known red-backed spiders *Lathrodictes hasselitii*, which are known as poisonous spiders and whose bite frequently affects a nervous person very severely, causing the glands under the arms and various parts of the body to swell, and producing severe itching in the soles of the feet. Fortunately these spiders have a very small mouth, and do not try to bite anybody unless they are caught or get crushed.—W. W. GOODACRE, Senior Apiary Inspector.

Pure Seed.

GROWERS RECOMMENDED BY THE DEPARTMENT.

THE Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Potatoes:—

Carman, No. 1	Alf. Piper, Llangothlin.
Coronation	J. W. Jay, Ben Lomond.
Early Manistee	Alf. Piper, Llangothlin.
Early Rose	W. E. Franklin, Lammer Moor, Oberon.
Factor	J. W. Jay, Ben Lomond.
	J. Piper, jun., Llangothlin.
	K. Bowen, Newport P.O., Orange.
Langworthy	K. Bowen, Newport P.O., Orange.
Late Manhattan	K. Bowen, Newport P.O., Orange.
Satisfaction	W. E. Franklin, Lammer Moor, Oberon.
Surprise	Alf. Piper, Llangothlin.
*Symington	H. F. White, "Bald Blair," Guyra.
†Teasdale	B. C. Meek, Hobby's Yards.

Maize:—

Boone County White	J. Chittick, Kangaroo Valley.
Cocke's Prolific	Manager, Experiment Farm, Lismore.
Early Clarence	F. T. Dowling, Tumut.
Fitzroy	Manager, Experiment Farm, Grafton.
	D. J. Dorward, Tayfield, Cundletown.
	J. P. Mooney, Taree.
Golden Glow	J. F. Chick, Tenterfield.
	W. H. Waters, Burradoo.
Golden Superb	W. H. McMahon, Pola Creek, via Kempsey.
Iowa Silvermine	J. H. Kerr, Little Valley, Elsmore, via Inverell.
Large Red Hogan	Principal, H. A. College, Richmond.
	G. E. Levick, Taree Estate, Taree.
Leaming	Manager, Experiment Farm, Grafton.
	J. Perrett, Miller's Forest, Hunter River.
Manning Silvermine	R. Dyball, jnr., Taree Estate, Taree.
Sundown (formerly North Western Dent)	J. S. Whan, Llangothlin.
Wellingrove	Manager, Experiment Farm, Glen Innes.
Yellow Hogan	J. Booth, West Kempsey.

Lucerne:—

Lucerne	R. J. Crosthwaite, Pilca Butta, Leadville.
	H. A. Mace, Fairview, Pallamallawa.

NOTES:—*Symington variety has about the same characteristics as to yield and size of potatoes as Surprise, and is otherwise similar, except that it shows a variation in the colour of the skin to Surprise.

†Teasdale variety is only cultivated in a small district, in which fairly good results have been obtained uring the past few years. It is a white-skinned tuber, with pink blotched eyes.

Sorghums :—	
Feterita	Manager, Wagga Experiment Farm, Bomen.
Milo	Manager, Experiment Farm, Cowra.
Manchu Kaoliang	Manager, Experiment Farm, Bathurst.
Saccaline	Manager, Experiment Farm, Lismore. Under-Secretary, Dept. of Agriculture, Sydney.
Grasses : —	
Paspalum Dilatatum	Manager, Experiment Farm, Wollongbar.
Gramma :—	
American Pear	R. Dyball, jun., Flettwood Bag, Taree.
Peanuts : —	
Chinese	Manager, Experiment Farm, Grafton.
Valencia..	Manager, Experiment Farm, Grafton.
White Spanish	Manager, Experiment Farm, Grafton.
Pop Corn :—	
Black Beauty	Manager, Experiment Farm, Bathurst.
White Rice	Kable and Son, Orton Park, via Bathurst.
Sudan Grass :—	
Sudan Grass	Manager, Experiment Farm, Cowra. Manager, Experiment Farm, Temora. Manager, Experiment Farm, Yanco.
Broom Millet :—	
Broom Millet	W. G. Chaffey and Sons, Tamworth.

THE INFLUENCE OF COLD UPON PLANT GROWTH.

THE general belief that trees and shrubs become dormant because of the cold, and that warm weather is in itself the sufficient cause of the beginning of new growth in spring, is contradicted by certain experimental results reported by F. V. Colville, Pennsylvania, U.S.A.

Dormant trees and shrubs which had had two or three months of chilling, either outside or in artificial cold storage, started into growth in the normal manner in the spring, but if kept warm all the winter they did not start into growth at the usual time, but continued their dormant condition for weeks and months, and sometimes for a whole year. When finally growth commenced it was of an abnormal character. One of these dormant plants was found to be readily started into healthy growth, even after a year, by subjecting it to a period of chilling. The best temperature for chilling was 32 to 40 deg. Fah., applied either in light or darkness. By subjecting one part of a dormant bush to a chilling temperature and keeping another part of it warm, the chilled portion was brought into full leaf and flower, while the other part remained completely dormant.

During the process of chilling the starch stored in the cells is transformed into sugar, and this is necessary before the plant can utilise its store of starch in making spring growth. If warmth alone would start growth, the stored food required by the plant for its normal growth the following spring would be wasted in a burst of new autumn growth, which would be killed by the first heavy frost and cause ensuing weakness and probable death.

Poultry Notes.

AUGUST.

JAMES HADLINGTON, Poultry Expert.

PRESENT indications are that a record number of chickens are being reared this season. It, therefore, follows that there will be a much larger number of cockerels to market from this month onward.

The question of the disposal of these surplus male birds is receiving very serious consideration by the men who are guiding the industry commercially, and there is now a movement on foot to endeavour to cold-store dressed poultry during the season when glut conditions might be expected. The larger number of very early hatched chickens this year is likely to result in cockerels of the griller class being plentiful any time after the middle of September.

Owing to the continued high prices for foodstuffs, a glut in cockerels at any stage will have very serious consequences for the poultry-farmer, should prices fall below the cost of production. There are many poultry-farmers who will aver that cockerels do not pay to rear, and as a consequence they send them into market at a very early age to be got rid of at whatever price they will realise. This practice has in part been responsible for gluts and low prices in the past. To what extent this practice will accentuate the difficulty this season remains to be seen. Certain it is that, unless poultry-farmers concentrate on this problem and endeavour by sound methods of marketing and generally careful handling of the situation, cockerels that are hatched later than the end of July may not be profitable.

Judging by the number of very early chickens now being reared it is fairly conclusive that grillers will be a drug on the market from September onwards. It is not that there is no demand for this class, but the fact that many poultry-farmers are so circumstanced that these very young cockerels must be got out of the way, either to make room for pullets or to be got off the food bill. These necessitous farmers, together with those who think that cockerels will not pay to rear to a more advanced age, are the real cause of the collapse of the market and the conditions already mentioned.

Export of Table Poultry.

A good deal has been said and written about the prospects of exporting dressed poultry, and this business might become an accomplished fact if only poultry-farmers were convinced that it would pay to rear the birds to the weight required to make them suitable for export. It is no use to attempt to export or cold-store weedy or poorly grown cockerels such as usually glut the market.

Plump birds, weighing 3 lb. to 4 lb. dead weight, are required for export. Such birds make 1s. 8d. to 2s. per lb. in Sydney over the greater part of the year. Not that the producer always gets these returns, but the consumer pays at such rates for them. It follows then that it is for farmers themselves to devise a means whereby they will reap a better reward for their products of this character. First of all, they must grow them, instead of as at present treating the cockerel portion of their output as a by-product to be got out of the way, and practically thrown at the market at a stage of growth when they are too small to be regarded as table poultry other than grillers.

A poultry-farmer who does not make his cockerels pay is carrying too big a handicap on the returns from his hens. It is fully realised that there are times when the markets are so congested with cockerels (principally between 1st January and the end of March) that only very prime sorts will realise payable prices.

Cold storage appears to be the solution of the problem. It is by no means easy to bring into being the necessary organisation to deal with it, but it is safe to say that the greatest obstacle to the consumation of this project when tackled will be found in the fact that a very large proportion of the cockerels marketed are neither fit for cold storage nor for export; and before any good can come to poultry-farmers in these directions they will have to realise more fully these facts, and mend their ways. In other words, when farmers decide to grow their male birds to such age and weight as will comply with the class of bird in demand, and learn to market them when they are ready (and not when it suits their convenience to get them off their farms) shall we have a sound commercial practice that will fit in with present day practices with regard to the disposal of eggs.

Some temporary sacrifices might have to be made before the object in view has been attained, but such sacrifices have been endured to put eggs on a better footing, and this should point the way to a better organisation for securing a payable return for the cockerel output of the farm.

The Feed Position.

The high cost of feeding poultry is at present causing farmers some concern. Mill offal is now nearly double the price which ruled some few months back, and which was looked upon as something approaching a normal price. This is the fourth period during the last eight years that pollard and bran have soared in price to £10 and over per ton, and during that time wheat and maize have approximated 6s. per bushel, and sometimes over. With regard to the latter, it has not so generally been due to shortage as to other causes. There is, however, little doubt that the expansion of the poultry industry, coupled with the fact that the high prices obtainable for butter, which has caused much of the mill offal to be fed to dairy stock, has assisted to bring about a chronic state of high prices for these articles.

The remedy of this state of things appears to lie in the direction of supplementary articles that will, to some extent, replace bran and pollard in the morning mash. So far, only lucerne meal has given much promise in this direction, and, unfortunately, in conjunction with the coarse pollard now almost generally obtainable, it accentuates the difficulty of making an adhesive mash ; without such adhesiveness, a good deal of waste occurs, and the mash is less appetising to the birds, two features that operate in the direction of lower production.

An Experiment with Lucerne Meal.

Owing to the frequent shortages of pollard and bran, with their untoward consequences to the poultry industry, the Department of Agriculture last year decided to carry out experiments with different foodstuffs, with a view to supplementing the articles in general use in the morning mash. Various foodstuffs came under examination at the time the matter was under consideration, but none gave such promise as lucerne-meal. Attention was therefore centred upon this article with a view to finding, if not a cheaper food, at least a supplementary one, that would to some extent relieve the situation in time of shortage of pollard and bran. The experiment was carried out at Hawkesbury Agricultural College from 1st August last year until 31st March this year—a period of eight months.

The experiment comprised six groups, each containing twenty pullets. Two groups were used as controls, and were fed the ration containing 15 per cent. lucerne-meal in general use at the College. Two of the experiment pens were fed a ration wherein the lucerne-meal was increased to 30 per cent., the remaining ingredients being the same as the normal ration. In the ration of the other two pens, the lucerne-meal was retained at 30 per cent. and wheatmeal at the rate of 20 per cent. was included, the idea being to introduce, in the form of the flour contained in the wheatmeal, a larger percentage of carbohydrates to balance the lack of that ingredient in the lucerne-meal.

The results, however, did not bear out the theory in favour of the extra carbohydrates contained in the wheatmeal necessary to balance the ration in this connection.

The Results.

It is not considered that the results of this one experiment can be taken as conclusive, and it is, therefore, intended to repeat it. However, so far as it goes, it is fairly indicative that up to 30 per cent. of lucerne-meal can be fed with but a slightly reduced egg-production as compared with the ordinary 15 per cent. now forming part of the normal ration at the College. Although lucerne is dear at present, this should be welcome news to those engaged in the poultry industry, because lucerne is not always dear, nor are pollard and bran in plentiful supply, and any supplementary poultry food should be welcomed, if only for the fact that it increases the available supply.

A Useful Supplementary Food.

Recently the Department was advised by a city firm that some considerable quantity of rice-meal was available, and they sought advice as to its value as a poultry food. No time was lost in submitting this meal to the Chemist's Branch for analysis, and the following is a copy of the report on the two samples submitted:—

	Superfine Rice Pollard.	Brown Rice Pollard.
Moisture	10·50	10·80
Albumenoids...	10·85	12·25
Ether extract	10·93	15·34
Ash	5·62	8·83
Fibre	1·32	4·72
Carbohydrates	60·78	48·06
	100·00	100·00
Albumenoid ratio	1 to 8	1 to 6·7
Nutritive value	96·2	94·8

Mr. F. B. Guthrie, Chemist, considered that the above should be good feed, with the proper addition, for stock-feeding purposes. The sample marked "brown rice pollard" was particularly rich in fat, and both products compared favourably in feeding value with mill products from wheat, oats, maize, &c., analysed by the Department.

Some trials on a small scale were sufficient to show that 10 per cent. of this rice-meal was sufficient very materially to improve the consistency and adhesiveness of the wet mash when composed of the usual parts of pollard, bran, and lucerne-meal.

This 10 per cent. of rice-meal in place of a like amount of pollard or bran will make but a slight difference in the balance of the ration, however, and an additional 1 per cent. of meat-meal will supply the necessary extra amount of proteins in which the rice is deficient, and will maintain the balance at approximately that of the usual ration recommended by the Department.

There are, therefore, two points of advantage in using up this available supply of rice-meal. One is that it is a supplementary food, and as such will be a welcome addition to our food supply, and the second is that it materially improves the mechanical consistency of the mash.

In this connection it might also be mentioned that oaten pollard, which is sometimes available in Sydney, and would be more so if regularly used, another good binding agent for the mash, and for all practical purposes might be considered as of similar value as a food for poultry.

Orchard Notes.

AUGUST.

W. J. ALLEN and S. A. HOGG.

IT is getting rather late now to plant deciduous trees, it being preferable to plant them in the months of June and July, but if planting has been delayed a bucket of water to each tree after it has been planted will greatly assist in successfully establishing it.

Citrus trees may be planted out this month. Where possible orange trees in particular should be well puddled after lifting; that is to say, the roots should be dipped in a thick puddle of clay and water so that a coating adheres, which should not be removed before planting. If possible, a bucket of water should be added when the tree has been put in place.

Extreme care should always be taken in the handling and planting of citrus trees. At no time should the roots be exposed to the sun or weather, and the sooner they are planted after being removed from the nursery row the greater the likelihood of success.

Grafting Fruit Trees and Vines.

This operation is generally carried out this month; it should be performed when the sap is just starting to rise. The period may be extended somewhat in the case of apples and pears, where it has been found that scions which were placed on stocks upon which the buds had already started will make a good union. However, this is not advisable, it being preferable to perform this work while the buds are practically dormant, though the sap in the stock should be moving.

Where fruit trees have proved unprofitable they should be worked over to varieties that are doing well under similar conditions.

The question has been asked whether old apple trees can be worked over to pears and vice versa. This practice has not proved a success and cannot be recommended. Apple stocks should be confined to apples and pear stocks to pears.

Great care should be taken in the grafting of old trees to see that the scion contains a bud close to its base, as in case of accident where part of the scion may be blown off at any time, this bud may then be relied upon to take the place of the upper one which may have been blown off.

In cases where vines are to be grafted the soil should be removed to a depth of about 3 inches around the stock, and having inserted and firmly joined the scion the whole may be covered up with earth as a protection until they have formed a union. As this mound is very apt to become encrusted, the scion should be examined from time to time and the mound loosened by means of a forked hoe.

After the scion has started to grow see that it has not thrown out independent roots, but is obtaining sustenance from the parent stock. Any roots upon the scions should be removed.

Spraying.

There is every indication that woolly aphis will be troublesome this season; and that being so precautions should be taken to combat the pest before the trees come into blossom or the leaves are formed. Where woolly aphis are very thick, it will be necessary to apply heavy applications of spray, preferably with a concentrated nicotine solution; miscible oil may be used, but as a heavy drenching is necessary a pool of spray may accumulate round the butt of the tree and do harm.

It may be pointed out that, in applying these sprays for the eradication of woolly aphis, it is absolutely essential that the spray should be applied with some considerable force, it being necessary to remove the insects as well as to kill them by contact, as when they are very numerous they protect one another. Thus the outer layers of insects, although they may be killed, will act as a protection to those beneath. It is well known that aphis are particularly prone to lodge in abrasions in the tree or cuts caused by pruning. Therefore, where possible, little or no pruning should be carried out. In fact, if pruning is found to be necessary, it is recommended that the trees be thoroughly cleaned before that operation is carried out.

With regard to black aphis of peach trees, if the July application of concentrated nicotine solution was duly given the future attacks of this insect should not be very serious. At the same time, the trees should be given every attention and additional sprayings given, if required.

It should be understood that there is no permanent remedy for either woolly or black aphis, but by means of spraying they may be kept in check.

Manuring.

Up to the present the artificial manuring of many kinds of deciduous fruit trees has not proved to be profitable under some conditions; the application of farmyard manure has been beneficial under practically all conditions. Where green crops have been grown, if not already ploughed under, the work should be pushed on without delay, otherwise the ground will be beginning to dry out through the agency of the green crop and the natural lack of moisture.

PHOSPHATIC FERTILISERS.

PHOSPHATES serve at least five purposes in the soil :—

1. They cause an earlier development of the young plant than would otherwise occur.
2. They bring about a considerable development of fibrous roots.
3. They counteract the rankness of growth which is liable to occur on land supplied with nitrogen compounds.
4. They hasten ripening and improve the quality of grain.
5. They increase the feeding value of the ordinary fodder crops.

—E. J. RUSSELL, Director of Rothamsted Experiment Station.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1922.

Society.	Secretary.	Date.
Parkes P. A. and H. Association	J. Heel	Aug. 15, 16
Forbes P. A. and H. Association	E. A. Austen	,, 21, 22, 23
Murrumbidgee P. and A. Association (Wagga)	A. F. D. White	,, 22, 23, 24
Corowa P. A. and H. Society	J. D. Fraser	,, 29, 30
Grenfell P. A. and H. Association	G. Cousins	,, 29, 30
Gunnedah P. A. and H. Association	M. C. Tweedie	,, 29, 30, 31
Yanco A. Society (Leeton), (Spring Show)	W. M. Evans	Sept. 2
Junee P. A. and I. Association	T. C. Humphreys	,, 5, 6
Young P. and A. Association	T. A. Tester	,, 5, 6, 7
Northern A. Association (Singleton)	J. T. McMahon	,, 7, 8, 9
Hills District Fruitgrowers' Association (Galston)	B. F. Renant	,, 8, 9
Cootamundra A. P. H. and I. Association	Wm. A. Sowter	,, 12, 13
Cowra P. A. and H. Association	E. P. Todhunter	,, 12, 13
Ganmain A. and P. Association	A. R. Lhuede	,, 12, 13
Albury and Border A and H. Society	A. G. Young	,, 12, 13, 14
Canowindra P. A. and H. Association	John T. Rue	,, 19, 20
Holbrook P. A. and H. Society	Jas. S. Stewart	,, 19, 20
Temora P. A. H. and I. Association	A. D. Ness	,, 19, 20, 21
Burrowa P. A. and H. Association (Boorowa)	W. Burns	,, 21, 22
Murrumburrah P. A. and I. Association	W. Worner	,, 26, 27
Henty P. and A. Society	H. Wehrman	,, 26, 27
Narrandera P. and A. Association	W. H. Canton	,, 26, 27
West Wyalong P. A. H. and I. Association	Thos. A. Smith	,, 26, 27, 28
Condobolin P. A. H. and I. Association	H. Monro	Oct. 3, 4
Hay P. and A. Association	C. L. Lincolne	,, 4, 5
Berrigan A. and H. Society	R. Wardrop	,, 10
Tweed River A. Society (Murwillumbah)	T. M. Kennedy	Nov. 22, 23

1923.

Society.	Secretary.	Date.
St. Ives A. and H. Association	A. K. Bowden	Jan. 12, 13
Kiama Agricultural Society	G. A. Somerville	,, 25, 26
West Bargo A. H. and I. Society	L. J. C. Hicks	,, 26
Wollongong A. H. and I. Association	W. J. Cochrane	Feb. 1, 2, 3
Tahmoor and Couridjan	E. S. Key	,, 9, 10
Yanco A. Society (Leeton)	W. M. Evans	,, 13, 14
Shoalhaven A. and H. Association	H. Rauch	,, 14, 15
Guyra P. A. and H. Association	P. N. Stevenson	,, 20, 21, 22
Nepean District A. H. and I. Society (Penrith)	C. H. Fulton	,, 22, 23, 24
Newcastle A. H. and I. Association	E. J. Dann	,, 27, 28, Mar. 1, 2, 3
Oberon A. H. and P. Association	C. S. Chudleigh	Mar. 1, 2
Central New England P. & A. Assoc. (Glen Innes)	Geo. A Priest	,, 6, 7, 8
Hunter River A. and H. Assoc. (West Maitland)	J. S. Hoskins	,, 7, 8, 9, 10
Berrima A. H. and I. Society	W. Holt	,, 8, 9, 10
Campbelltown A. Society	J. T. Deane	,, 9, 10
Mudgee A. P. H. and I. Association	S. H. Somerville	,, 13, 14, 15
Crookwell A. P. and H. Society	C. H. Levy	,, 15, 16
Camden A. H. and I. Society	G. V. Sidman	,, 16, 17
Rydal A. H. and P. Assoc.	S. B. Prior	,, 17
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins	,, 21, 22
Royal Agricultural Society of N.S.W.	E. J. Rafferty (acting)	Mar. 26 to April 4

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Agricultural Gazette of New South Wales.

Field Experiments with Oats.

RESULTS OF SEVEN YEARS' TRIALS WITH FERTILISERS.

Glen Innes Experiment Farm.

R. G. DOWNING, B.Sc. (Agr.) and L. G. LITTLE, Experimentalist.

THE object of trials conducted at this farm during the past ten years has been to determine the effect upon the yield of oats of the application of simple and mixed fertilisers when applied at the time of planting, the fertility and humus content of the soil being maintained by a suitable rotation.

The fertilisers—(1) sulphate of ammonia or dried blood, (2) superphosphate, and (3) sulphate of potash—have been tried singly and in various combinations, being compared with the results obtained from unfertilised plots. A mixture of dried blood, superphosphate, and sulphate of potash has also been compared with a mixture of sulphate of ammonia, superphosphate, and sulphate of potash, with the object of determining whether the organic form of nitrogen may be replaced by the artificial. The quantities used of the various fertilisers have been as follows:—

Dried blood, 20 lb. per acre (containing 2¾ lb. nitrogen).
Sulphate of ammonia, 132½ lb. per acre (containing 2¾ lb. nitrogen).
Superphosphate, 88 lb. per acre (containing 15 lb. phosphoric acid).
Sulphate of potash, 11½ lb. per acre (containing 6 lb. potash).

It was realised after the experiment had been in progress a short time that these rates were very low, and that heavier applications would probably give more profitable returns, but it was considered advisable to continue the experiment on the same lines for the full period, since the results with even these light applications were quite definite. A new fertiliser experiment on somewhat similar lines with heavier applications was commenced at Glen Innes this year.

Rotation.

The treatment of the paddock in which this experiment was located was on the following cropping system:—

1. Oats.
2. Renovation crop (rye-grass and clover, fed off by sheep).
3. Maize for silage.

This rotation was adopted for the whole of the experiment area, and it was only changed in 1920 for reasons that need not be discussed here, as the alteration did not affect the results in any way.

The Soil.

The plots were situated on a comparatively low-lying area, the soil being of a greyish clay of metamorphic ironstone derivation. The subsoil is only 6 inches from the surface and consists of a yellow clay. The soil is not suitable for maize and potatoes, but is satisfactory for oats and wheat, and is typical of a considerable area of the poorer type soil in parts of the district.

The Management of the Experiment.

The plots (one-eighth acre in area) were sown with the 15-disc seed drill, and measured 27 links wide by 480 links long. The length was reduced before harvesting, and one half of the plots lengthwise was cut for hay, and one half for grain. The half plot intended for hay was cut mostly by hand, the sheaves being stooked to dry in the field and weighed when quite dry. The remaining half was cut with the binder and stacked, to be put through the grain thresher later. Algerian oats was the variety grown throughout the trials.

The yields were influenced slightly by storms at harvest, but these influences were such as would affect any crop. For example, in 1913, Plot 12 suffered more damage than Plot 13, because it was more forward and shattered more easily. That would be liable to happen in any field crop under similar conditions, and despite this reduction the average yield revealed a large increase.

The results for the seasons 1913 to 1916 inclusive are not included in these averages, because during that time the treatment of the rotation crops was irregular, with possibly some influence on the yields for those years. Hay yields were not taken in 1918 and 1919.

The amounts charged for the fertiliser applications in the table on the next page are irrespective of the general growing and harvesting costs, which would vary slightly according to yield.

The standards of values used are those current at 30th June, 1921, as follows:—

Dried blood ... ... 22s. 0d. per cwt. = 20 lb. for 4s. 0d.
Sulphate of potash ... 36s. 0d. „ = 11½ lb. for 3s. 9d.
Sulphate of ammonia... 22s. 9d. „ = 13½ lb. for 2s. 9d.
Superphosphate ... 7s. 0d. „ = 88 lb. for 5s. 6d.

Hay, £3 per ton. Oats, 3s. per bushel.

The Results.

Superphosphate has in every season, without exception, shown its effect upon the growth of the crop within four to six weeks of planting. At that period the superphosphate plots (whether that fertiliser was applied singly or in mixtures) have shown a healthy vigorous growth, while the plots to which no superphosphate has been applied have passed through a period of

TABLE showing the treatments in order according to the amount of profit earned by each fertiliser after allowing for the cost :—

Fertiliser.	Yield per acre based on percentage.	Increase.	Value of increase.	Cost of increase.	Nett gain.
	Grain Yields.				
	bus. lb.	bus. lb.	£ s. d.	£ s. d.	£ s. d.
Blood, potash, superphosphate ...	51 23	14 23	2 3 6	0 13 3	1 10 3
Superphosphate	46 14	9 14	1 8 0	0 5 6	1 2 6
Ammonia, potash, superphosphate	48 19	11 19	1 14 6	0 12 0	1 2 6
Blood, superphosphate	46 28	9 28	1 9 3	0 9 6	0 19 9
Superphosphate, potash	46 8	9 8	1 7 9	0 9 3	0 18 6
Blood	39 28	2 28	0 8 3	0 4 0	0 4 3
No fertiliser (*check*)	37 0	...	....	... .	(loss)
Potash	38 0	1 0	0 3 0	0 3 9	0 0 9
Blood, potash	37 19	0 19	0 1 6	0 7 9	0 6 3
	Hay Yields.				
	t. c. q.	c. q.	£ s. d	£ s. d.	£ s. d.
Blood, superphosphate	2 16 2	15 3	2 7 3	0 9 6	1 17 9
Superphosphate	2 14 1	13 2	2 0 6	0 5 6	1 15 0
Blood, potash, superphosphate	2 15 3	15 0	2 5 0	0 13 3	1 11 9
Ammonia, potash, superphosphate	2 14 2	13 3	2 1 3	0 12 0	1 9 3
Superphosphate, potash	2 12 1	11 2	1 14 6	0 9 3	1 5 3
Potash	2 5 2	4 3	0 14 3	0 3 9	0 10 6
Blood	2 2 2	1 3	0 5 3	0 4 0	0 1 3
No fertiliser (*check*)	2 0 3	......	.. ..	....	(loss)
Blood, potash	2 1 3	1 0	0 3 0	0 7 9	0 4 9

YIELDS per acre for individual years, based on percentage yields.

Year.	Check No Fertiliser.	Dried Blood	Superphosphate.	Sulphate of Potash.	Blood and Superphosphate.	Blood and Sulphate of Potash.	Superphosphate and Sulphate of Potash.	Blood, Superphosphate and Sulphate of Potash.	Sulphate of Ammonia, Superphosphate, and Sulphate of Potash.
	Grain Yields.								
	bushels.	bushels.	bushels.	bushels	bushels.	bushels.	bushels.	bushels.	bushels.
1911	48·7	58·62	57·86	53·97	68·05	48·02	64·87	61·11	64;57
1912	48·2	46·33	51·03	52·21	56·46	50·69	51·13	53.00	55·54
1917	40·5	43·41	46·85	41·15	45·80	39·32	48 42	64·84	54·75
1918	17·2	16·37	19·33	16·61	20·12	14·87	21·74	27·37	20·00
1919	24·2	24·39	37·39	30·68	36·85	35·18	41·57	44·43	45·78
1920	56·0	65 10	71·00	42·80	67·70	49·00	65·60	75·60	67·20
1921	24·5	23·10	41·00	23·40	32·00	25·25	30·15	34·30	31·50
Averages .	37·04	39·71	46·34	37· 9	46·71	37·47	46·21	51·59	48·48
	Hay Yields.								
	t. c. q. lb.	t c. q. lb.	t. c. q lb.	t. c. q. lb.	t. c. q. lb.	t. c q. lb.	t. c. q. lb.	t. c. q. lb.	t. c. q. lb
1911	2 7 2 21	2 10 1 12	3 12 0 17	2 16 2 6	3 16 3 19	2 7 1 1	2 19 2 1	3 9 1 20	3 13 3 [illegible]
1912	1 9 2 7	1 [illegible] 0 16	1 14 2 26	1 11 3 18	1 11 1 0	1 11 0 14	1 17 1 26	1 18 1 24	2 3 0 2
1917	1 14 1 10	1 16 2 12	2 8 3 13	2 1 1 3	2 14 1 1	1 15 3 27	2 5 1 1	2 8 0 13	2 5 3 1
1920	2 11 2 24	2 14 2 12	3 1 0 14	2 13 1 4	3 14 0 14	2 12 3 0	3 7 0 8	3 6 3 1	3 13 3 [illegible]
Averages*	2 0 3 0	2 2 2 0	2 14 1 0	2 5 2 0	2 16 2 0	2 1 3 0	2 12 1 0	2 15 3 0	2 14 2 [illegible]

* Reckoned to nearest quarter.

stagnation, the plants showing a reddish tinge and looking quite unhealthy by contrast with the former plots. From that time on the superiority of the superphosphate applications has been apparent in increasing degree until maturity, which stage has been reached a week or so earlier than in the remaining plots. The other fertilisers, it will be noticed, have had but little effect singly or combined, but when superphosphate is added, a definitely beneficial effect becomes apparent, which seems to make the practice worth while. The best results in practically every season have been obtained from one or other of the complete fertiliser mixtures.

The experiment has established the fact that an application of superphosphate at 80 lb. per acre when sowing is a payable proposition in this district, and should be adopted by all farmers. It further shows that the addition of a small quantity of a nitrogenous and potassic fertiliser to the superphosphate will yield a good profit, and that for the poorer soils of this district the application of such a complete manure at planting time should form a basic principle of farm practice in the growing of cereal crops.

The years 1911 to 1921 cover two drought periods that were general throughout the State, and two or three seasons of bumper crops. The dry periods are the best for agricultural results in this district, for good crops are obtained even in these seasons when best prices prevail. Wet seasons are not productive of the best results, for though the yields may be heavy, the losses through lodging, shattering, &c., are also heavy.

The sound position of agriculture in this district, although not generally recognised, is apparent upon a consideration of the above figures. An average yield of over 2 tons of hay per acre, and 42 bushels of grain from unmanured plots cannot be equalled in more than a few favoured localities in this State, while the increase of these yields to 2¾ tons and 54 bushels respectively shows the extent to which up-to-date methods may improve the standard of farming in the district.

The estimated values of hay at £3 per ton and oats at 3s. per bushel are considered to approximate the average value for the past ten years. The costs for fertilisers are on the highest scale in the whole period, yet the financial return is something like this:—

Hay—

Nett gain from application of complete fertiliser per acre per year ... ... = £1 10 3
Increased annual return from 100 acres so treated ... = £151 5 0
Increased return for ten years from 100 acres per year... = £1,512 10 0

Grain—

Nett gain from application of complete fertiliser per acre per year ... ... = £1 3 9
Increased annual return from 100 acres so treated ... = £118 15 0
Increased return for ten years from 100 acres per year... = £1,187 10 0

Below are presented in tabular form, particulars regarding cropping and seasonal conditions which should be considered in conjunction with the tables above.

Year.	Rate of seeding.	Date sown.	Date Harvested	Rainfall.	Remarks.
	lb.			Points.	
1911..	40	6 July	(*a*) 11 to 18 December, 1911. (*b*) 20 December, 1911	(1) 1,426 (2) 1,433 (3) 3,171	Land cleared 1909–10 and ploughed winter, 1910, fallowed till April, 1911, reploughed, disced, rolled, harrowed, sown. Very heavy rain January ; dry harvest.
1912 .	60	17 August	(*a*) 18 December, 191 (*b*) 15 January, 1913	(1) 777 (2) 962 (3) 2,398	After maize for silage 1911–12. Cleared as above—first crop of oats. Heavy rain June and July ; dry harvest.
1913	60	23 July	(*a*) 4 December, 1913 (*b*) 24 December, 1913	(1) 888 (2) 1,426 (3) 3,326	Cleared 1909–10 Clover and rye grass 1911 ; maize for silage 1912 Heavy rain May, June, December ; wet harvest.
1914 .	60	7 May	(*a*) 25 November, 1914 (*b*) 8 December, 1914	(1) 1,402 (2) 1,499 (3) 3,288	Cropped according to the 3 course rotation. Good rain January, March, October, December ; very dry July, August, and September.
1915	60	5 May	(*a*) 15 November, 1915 (*b*) 29 November and 7 December, 1915	(1) 1,050 (2) 1,050 (3) 2,171	Fair rain February, July, and December Very dry October and November.
1916	60	16 May	(*a*) 20 December, 1916 (*b*) 23 January, 1917	(1) 2,517 (2) 2,517 (3) 4,051	Very heavy rain February, April, June, July, August, November, December. Wet harvest for hay ; fine for grain.
1917	58	10 July	(*a*) 12 December, 1917 (*b*) 8 January, 1918	(1) 2,190 (2) 2,586 (3) 3,840	Very wet January, February, September to December ; extremely dry March to August Wet harvest.
1918	63	28 June	(*a*) No hay (*b*) 18 December, 1918	(1) . (2 1,043 (3) 2,094	Plots cut for grain—very dry planting. Wet in January ; very dry winter and generally droughty
1919.	78	20 June	(*a*) No hay (*b*) 27 November, 1919	(1) (2) 422 (3) 1,927	Plots cut for grain. Fair rain February, March, and May ; good in December ; dry winter.
1920.	68	30 July	(*a*) 20 December, 1920 (*b*) 30 December, 1920	(1) 1,466 (2) 1,555 (3) 3,624	Heavy rain in January, June, July, September, and December ; dry harvest

Date harvested :—(*a*) Hay cutting date and (*b*) Grain harvesting (with Binder) date.
Rainfall :—(1) During hay growing period, (2) During grain growing period, (3) Total annual fall.

A FERTILISER QUERY.

"CAN you inform me," wrote a correspondent recently, "if blood and bone manure is subject to deterioration by storing? I have been offered a quantity which has been lying in bags in a shed open on the northern side but protected from the rain. I would like to know whether, during the period of storing, any loss in the nitrogen or phosphoric acid content is likely to occur."

Provided the fertiliser was protected from the weather, and the original sample was in good condition, dry, and not evolving ammonia, the writer was informed, there should not be any appreciable loss in quality.

SIZE OF THE AVERAGE WHEAT FARM.

THE Department of Agriculture is indebted to Mr. H. A. Smith, Government Statistician, for the opportunity of quoting the following from the "Official Year Book of New South Wales" (*in the press*):—

The expansion of the wheat industry has been brought about more by reason of the fact that growers have cultivated larger areas than by any marked increase in the number of growers, although in bad seasons, such as 1918–19–20, it was evident that many former growers did not plant crops.

The following table illustrates the recent development of wheat-growing in respect of number and average size of areas sown:—

Year.	Holdings on which Wheat was grown.	Total Area sown with Wheat.	Average Area per Holding devoted to Wheat.
	No.	acres.	acres.
1900-01	20,149	1,862,752	92
1905-06	19,049	2,253,029	118
1915-16	22,453	5,122,245	224
1918-19	17,281	3,227,374	187
1919-20	16,266	3,068,540	188
1920-21	17,790	3,663,352	206
1921-22	18,625	3,689,110	198

The following table provides a summary of the areas of holdings on which wheat was grown for grain in the season 1920–21, arranged in groups according to the area cropped for grain:—

Area Cropped for Grain—Series.	Holdings.	Wheat-grain		
		Area cropped.	Production.	Average per acre.
acres.	No.	acres.	bushels.	bushels.
1-49	3,871	80,398	1,381,116	17·2
50-299	8,480	1,285,186	23,270,817	18·1
300-999	3,098	1,407,709	24,936,471	17·7
1,000-1,999	171	218,046	3,818,931	17·5
2,000-10,484	38	136,038	2,218,023	16·3
Total	15,658	3,127,377	55,625,358	17·8

A QUESTION CONCERNING SEED POTATOES.

COULD the Department inform him, wrote a correspondent on the subject of seed potatoes recently, whether it is wise or otherwise to rub off, before planting, shoots that have attained a length of, say, a quarter of an inch.

The writer was informed that it is inadvisable to rub off the short shoots of seed potatoes. When seed potatoes are stored in bags and long white shoots are formed, it is usual to rub off these, as they are so tender that in handling they would inevitably become bruised or broken. Seed potatoes should be spread out in the light early in the season in order to induce the formation of short, sturdy shoots. These first shoots are the more vigorous, and seed that has been so treated is in an ideal condition for the production of early crops. The character of a potato shoot is an indication of the vitality of the seed. Seed potatoes with spindly shoots should be discarded. —A. J. PINN, Inspector of Agriculture.

Oats on the Wheat Farm.

J. T. PRIDHAM, Plant Breeder.

On very few farms is any proper provision made for the storage of oats. They are usually kept in bags and sold cheaply to obtain ready cash or to save the crop from the ravages of mice—mice, like other classes of "live-stock," preferring oats to any other kind of grain except, perhaps, linseed.

It is suggested that the erection of bins or silos would be a profitable investment in connection with oat-growing. This cereal has now become a necessary adjunct to wheat production, both because of its relative resistance to take-all and foot-rot, and on account of its value for stock. Oats are cheap early in the year, but advance considerably in price (and incidentally in feeding value, becoming more matured) towards the end of the year. Whether the grower markets the grain, or uses it for feeding stock at a time when grass is scarce, the oats would soon pay for the cost of storage accommodation. Rats and mice will always have to be reckoned with, and the farmer might well ask himself whether it would not be more profitable to make fewer oat stacks, and erect a grain bin or two instead. With chaffed straw and a grain ration of oats both horses and sheep do well, and straw stacks are not likely to be fouled much by vermin. It is desirable to have the oats stored under cover of a shed, so that the grain can be crushed in wet weather. Even if in the end all is sold off the farm, a large bin should soon pay for itself. As closer settlement proceeds, hand-feeding of sheep is likely to become more general, and even now the State does not produce nearly all the oats consumed, considerable quantities being imported from Victoria; so that there should be a safe market if the grain can be stored till prices are satisfactory.

Large corrugated iron tanks are used successfully in parts of Victoria for storing oats, but, although perhaps the best, a tank is not the only container available—satisfactory silos may be made with wood, which should be well-seasoned, dressed timber, tongued and grooved, if possible They should be six or eight-sided in shape and set in a clay or concrete bed on a well-drained site A sliding door should be provided at the bottom of the silo, like the grain door of a harvester.

It is important to give the crop a fair chance, cultivating it properly and using good seed of a suitable variety, so that storage room will not be wasted with a light, pinched sample. Oats take up a good deal of space if they are not well filled and thoroughly threshed in harvesting; thus it is not economical to grow a light weight grain. We can produce heavy grain in dry districts, and the Department will always recommend a reliable variety for a given district.

It may here be remarked that the popular prejudice in favour of the short white oat has little to justify it. Connoisseurs of oatmeal porridge say it has a superior flavour to the Algerian and other varieties, but there are so few districts where the Scotch oat matures a good sample that the objection is not worth consideration. As a matter of fact, oat buyers state that both for horses and for human consumption oats of the Algerian type are sweeter and suit the trade better.

We have varieties to suit every district, so that, given fair treatment, a plump sample can be grown in any season. Farmers have not given enough attention to this admirable concentrated fodder, which can be raised comparatively cheaply on every farm. We have spoken of oats for sheep and horses, but it has been found that crushed and steamed oats are superior to bran for milking cows, containing its mineral constituents and far more oil, while, if they are crushed finely and the husk sifted out, oats are valuable for pigs and poultry.

Summing up, it is not extravagant to say that for the farmer in the wheat districts storage for oats should be looked upon as almost as essential as storage for a domestic water supply.

FARMERS' RECEIPTS FROM THE WHEAT POOLS.

THE Department is indebted to Mr. H. A Smith, Government Statistician, for the opportunity of quoting the following from the "Official Year Book of New South Wales" (*in the press*) :

At June, 1922, the position of the various pools was as follows :—That of 1915-16 had been completed and all accounts settled ; those of 1916-17 and 1920-21 were known to be overpaid and awaited adjustment ; and the accounts of those of 1917-18, 1918-19, and 1919-20 were awaiting completion, payments of 3d , 1d , and 4d. per bushel in these pools respectively having been made on 12th April, 1922.

Although the amounts deducted to cover dockages for inferior wheat and rail freights produced some divergence in the actual returns to individual farmers, the following is an estimate of the average receipts per bushel by farmers for their wheat, delivered at the nearest railway siding in each of the harvests controlled by a compulsory pool :—

Season.	Total Amount Paid per bushel.	Average Deductions per bushel.			Amount per bushel received by Farmers at Railway Siding.
		Estimated Freight	Dockage.	Handling Charges.	
	s. d.	d.	d.	d.	s. d.
1915-16	4 10	3·60	·05	3·25†	4 3·1
1916-17	3 3	‡	1·63	‡	3 1·4
1917-18	4 3	4·00	·67	‡	3 10·3
1918-19	4 11	4·30	·01	‡	4 6·7
1919-20	7 10	4·58	·11	‡	7 5·3
1920-21	7 6	‡	·69	‡	7 5·3

† Flat rate. ‡ Not deducted.

The above statement was compiled from the records of the Wheat Board of New South Wales.

Farmers' Experiment Plots.

MAIZE EXPERIMENTS, 1921–22.

Upper North Coast District.

W. D. KERLE, Inspector of Agriculture.

THE farmers who co-operated with the Department in maize experiments in the season 1921–22 were :—

M. McBaron, "Riverview," Raleigh, Bellingen River.
S. T. Walker, "Cranbook," Deer Vale.
G. Long, "Glengarry," Tatham, Richmond River.
E. A. Green, The Risk, Kyogle.
Mrs. F. Johnson, Condong, Tweed River.
F. L. Playford, "Merrylands," Glenreagh, Orara River.
Wm. Barnes, "Heatherdene," South Woodburn, Richmond River.
Henry Short, "Warawee," Dorrigo.
E. A. Amps, "Goldsborough," Camira Creek.

Experiments were also sown at Grafton, Tyndale, Casino, and Burrapine, but owing to unsatisfactory germination the results were not comparable.

The Season.

The season was not a satisfactory one. The heavy flood rains of winter were general throughout the district, and disastrous floods were experienced in May and July. The latter, reaching record heights, inundated much of the land intended for early maize sowing. For two months following this flood very little rain fell, and it was impossible to work the ground, which was covered with silt or run together, and was with difficulty ploughed and with greater difficulty reduced to a sufficient degree of fineness to be suitable for sowing. For this reason quite a large percentage of early maize was sown in October, a month that is not recommended as a general practice if it can be avoided. Following the sowing, dry and hot conditions prevailed until the last week in December, when heavy downpours were experienced. The first month of 1922 was abnormally dry, but February was correspondingly wet, most of the rivers again overflowing their banks. The late-sown maize was checked in a number of instances by dry conditions in March and April. It would appear that, generally speaking, heavy rains in any one month should be sufficient for all requirements for the succeeding month or more, but this does not apply in the upper North Coast, where the temperatures are high and evaporation enormous. Perhaps more use of the cultivator or harrow could be made to form surface mulches, but the soil (and often the crop) does not always lend itself to this treatment when most desired.

RAINFALL RECORDS.

Month.	Coodong.	Glenreagh	Raleigh	Dorrigo.	Deer Vale.	Kyogle.	Camira Creek.	South Woodburn	Tatham.
1921.	from 5th.	from 13th.	from 25th	from 22nd.	from 21st.	–	from 7th.	points.	points.
October .	101	40	nil.	nil.	60		11	..	.
November	155	228	283	411	361	289	151	from 13th. 187	.
December	1,305	694	1,205	1,663	1,174	1,450	1,012	911	...
1922									from 11th.
January	125	225	329	831	512	126	123	176	144
February	1,560	2,252	2,074	2,430	2,506	971	1,231	1,087	956
March ..	..		...	...		175	.	159	216
April ..	.					40	.	.	34
May		...	...	.	.		.		213
Total ..	3,246	3,439	3,891	4,835	4,613	3,051	2,533	2,520	1,563

Cultural Details.

Raleigh.—Soil, alluvial loam; previous crops, 1920 maize, 1921 oats; previous to 1920, pasture for many years; sown 24th and 25th October; rows 3 feet 9 inches, 3 grains every 3 feet. Crop suffered by heavy rain in February, causing stalks to lodge and mouldiness in ears. The fertiliser trial disclosed a surprising increase from the use of superphosphate, notwithstanding the fertility of the soil.

Deer Vale.—Soil, yellowish, gravelly clay; elevation of site nearly 3,000 feet, being almost the highest portion of the Dorrigo plateau; country undulating; experiment plots on hillside; check plots provided every third plot to ensure uniformity of results. Site previously cropped to maize in 1920, immediately after being cleared of softwood scrub. Ground prepared by two ploughings; drills placed 4 feet apart, sowing being made on 20th and 21st October. Germination very satisfactory and growth excellent; very serious setback occurred at end of December, when a week of strong cold winds and heavy rain tore the leaves to ribbons, and generally played havoc with the crop. In February over 25 inches of rain fell, in fact only four days were experienced on which no rain fell. This excessive rain adversely affected the crop, Craig Mitchell and Iowa Silvermine in particular. The yields were high for the plateau, particularly in view of the erratic nature of the season. Golden Nugget, which gave the highest yield, was the latest maturing variety under trial, and should be sown at least a fortnight earlier in this locality to minimise the risk of frosts. The manurial trial with Leaming demonstrated the benefit of fertilising in this locality.

Tatham.—Soil, alluvial loam, typical of best riverbank lands of the Richmond; previous crop, winter fodders. Ground received three ploughings. Sown, 11th January. Germination unsatisfactory in Ulmarra Whitecap and Narrow Red Hogan, and light in most of the plots, owing to weevily seed. Season did not favour late sowing here, the growing period, particularly the later stages, being much dryer than usual, with the exception of February, when 956 points were recorded. Maize earworm was bad throughout the crop, and considerably reduced the yields. Fitzroy gave the highest yield, followed by Large Red Hogan. Coodra Vale, which is as early as Leaming, did remarkably well in its first trial.

A seed trial was conducted with Fitzroy, with the following result:—

Stud Seed, 66 bus. 16 lb.
Bulk Seed, 59 „ 24 lb.

The difference in favour of stud seed was thus 6 bushels 48 lb.

Kyogle.—Sown 16th November; soil, alluvial loam, fertile; condition at sowing time, excellent. Rows 4 feet apart; seed dropped three grains every 3 feet. Previous crop, maize. Season very erratic; at times too wet and at others too dry, particularly in the later stages of growth.

Condong.—Soil, alluvial loam on bank of Tweed River; covered by flood in July and 2 inches of silt deposited. Sown 5th October after winter fodders, which when 18 inches high were ruined by flood. Drills four feet apart and seed three grains every 2 feet 6 inches; sown by hand. The season was abnormally wet in December and February, and quite the reverse in all the other months of growth.

Glenreagh. The trial in this locality was one of fertilisers and varieties. It was sown on 13th October on light clay loam on the Orara River bank. The floods of May and July partially covered the site, and carried away much of the surface soil. The ground was with difficulty brought to a fit condition for sowing by ploughing several times, disc-cultivating and harrowing Seed and fertiliser were sown by hand, 140 lb. of superphosphate per acre being applied to the variety trial. The rainfall was rather more evenly distributed, although February registered 22·52 inches, and a fair percentage of mouldy maize resulted.

Mr. Playford took careful note of the waste maize when threshing, and the following comparisons were made:—Hickory King, 1 per cent.; Golden Superb, 6 per cent.; Leaming, 7 per cent.; Goldmine, 9 per cent.; Craig Mitchell, 14 per cent.; Iowa Silvermine 16 per cent., Funk's Yellow Dent, 25 per cent. This comparison reflects the degree of husk-covering of the varieties Craig Mitchell yielded particularly well in this experiment, and exceeded a local Whitecap variety that is very much grown in the locality by 14 bushels 32 lb. per acre This local variety, which was also beaten by Hickory King and Leaming, is white-capped, pink grained, and early maturing, and it has nothing to recommend it.

South Woodburn.—The trial of ten "poor land" varieties at this centre was sown on 14th and 15th November, on a light grey sandy soil of poor quality. The fertiliser mixture P7, at 134 lb. per acre, was sown with all varieties Germination was rather patchy owing to lack of moisture at sowing time. In the growing period the dry and hot months of January and March adversely affected the yields.

Dorrigo.—Soil, red volcanic loam; previous crop, maize, rows, 4 ft. 6 in. apart; seed and fertiliser sown with drill. Soil in fair condition at planting, but after cultivation was neglected and Summer grass over-ran the plots, possibly owing to the heavy precipitation and inability to get on the ground with the scuffler. Over 48 inches fell in the four chief months of growth, more than half of which fell in February. Heavy rains and strong cold winds at the latter end of December checked this crop very considerably. The yields obtained were very low, particularly in comparison with those at Deer Vale.

Camira Creek.—Two trials were arranged here, but that sown on 16th January failed to germinate satisfactorily owing to dry weather. Early varieties were sown on 6th and 7th October on land previously laid down to pasture. Soil, poor grey sand; superphosphate 250 lb. per acre was applied to varieties. A fertiliser trial with Hickory King germinated badly and was not harvested for grain.

Comments.

In the test of varieties this season, the behaviour of Craig Mitchell has been most worthy of note. In two out of the five entries where it was sown it gave the heaviest yield, and it was third and fourth in two; on the Bellinger, where it was badly effected by blight, it did not do well. It is not likely to be so consistent in all seasons as Leaming, or to command as high a price on the market, owing to its soft white grain. It is, however, much favoured by millers in Victoria, from which State it was introduced.

In the late-sown experiments, Fitzroy gave the highest return, and is undoubtedly the most reliable variety to grow on the coast for main crop sowings in November or December.

RESULTS of Variety Trials.

Variety.	Condong.		Glenreagh.		Raleigh.		Camira Ck.		South Woodburn		Deer Vale.		Dorrigo.		Kyogle.		Tatham.	
	bus.	lb.	bus.	lb	bus	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb
Craig Mitchell	84	14	71	53	61	29					63	33	26	11				
Iowa Silvermine	83	20	54	19	84	52	39	34	39	32	43	35	19	14				
Golden Superb	81	7	49	10	60	50					67	42	20	0				
Leaming	76	12	65	10	85	10	32	25	40	22	64	46	30	10	56	20	42	34
Fitzroy	74	21							47	40					72	48	62	12
Large Red Hogan	74	16													65	0	56	20
Early Clarence	71	24																
Hickory King ..	66	14	65	32	75	11	42	0	48	35	43	46	17	14				
Funk's Yellow Dent .	62	10	54	53	54	45	25	10	31	12								
Cocke's Prolific . .	57	14													52	8		
Leggett's Pride	54	21					40	44										
Goldmine ..			48	32	67	0			41	30			15	34				
Boone County White					72	26												
Shannon Vale Silvermine .					69	8												
Eureka .					62	7	38	23										
Manning Silvermine .							38	13	43	41			16	40	52	28	46	10
Golden Nuggett							37	11	51	42	72	37	28	16				
Yellow Mastadon							36	0	38	29								
Small Red Hogan											50	47	18	6				
Narrow Red Hogan															64	16		
Hawkesbury Hogan															61	24		
Ulmarra Whitecap .															58	32		
Pride of Hawkesbury															57	8	53	28
Yellow Hogan															56	24	49	24
Golden Drop .															53	48	42	42
Coodra Vale . .															51	24	54	14
Manning White .																	44	32
Early Morn (U.S. 133)													14	28				
King of Earlies													23	12				
Minnesotta													9	28				
Wellingrove									39	13								

The trials with fertilisers gave increases varying from 16 bushels 5 lb. to 8 bushels 10 lb. over unmanured, the most consistent mixture being P7, applied at 2¼ cwt. per acre. The results from potassic manures were not very satisfactory. The highest increase was that of 15 bushels 36 lb. with M6 at Deer Vale. Light applications of superphosphate proved inferior to no manure at two centres, and gave only small increases at all others. On the other hand, double the quantity (2½ cwt.) gave payable increases at all centres.

RESULTS of Fertiliser Trials.

—	Glenreagh.		Raleigh.		Deer Vale.		Dorrigo.		Tatham.	
Variety.	Leaming.		Leaming.		Leaming		Leaming.		Fitzroy.	
Sown 1921	13th Oct.		24th Oct.		21st Oct.		22nd Oct.		11th Jan	
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.
*P7 252 lb. per acre .	72	31	75	11	64	0	30	50	62	40
*M7 182 lb. ,, ...	69	29	76	28	54	47	25	40	58	26
*M6 224 lb. ,, ...	67	39	79	5	69	25	25	32	58	38
Superphosphate 140 lb. ,, .	65	24	67	24	62	34	26	25	51	48
Superphosphate 280 lb. ,, ...	62	47	85	8	63	41	30	10	61	8
*P7 134 lb. ,, .	58	50			57	48	25	25	...	...
No manure	56	26	72	34	53	45	22	40	52	10

*The fertiliser mixtures are made up as follows :- P7, equal parts of superphosphate and bonedust ; M6, five parts superphosphate and three parts chloride of potash ; M7, ten parts superphosphate and three parts chloride of potash.

"MANGE AND ALLIED MITES FOR VETERINARIANS."

THIS work, by A. W. Noel Pillers, consisting of 110 pages of letterpress, is well illustrated with micro-photographs (prepared by the author) of the various flesh and itch mites. In the preface the writer states that the book is "an extensive amplification of a lantern lecture delivered before the members of the Yorkshire Veterinary Medical Association."

It should be a useful handbook for medical men, stock inspectors, veterinary students, and others interested in the mites that infest men and animals, the life-history and identification of which are of great economic importance as disease-producing mites, such as the mange mite, the itch mite of man, and the sheep scab mites. The synonymy is given, and the modern classification followed. And a number of formulas are given dealing with the most effective method for destroying these mites. Our copy from the publishers, Baillière, Tindall and Cox, Covent Garden, London.

THE ABSORPTION OF SUBSTANCES BY FRUIT TREES.

THE idea of introducing substances into the sap of trees by boring holes into the tree trunks and placing the substances therein is not altogether new. Within recent years it has been suggested that trees treated with special substances on the above lines could be rendered free from insect pests. Experiments have been conducted by the Department to test whether insect pests could be controlled in this manner, but the results have indicated that the method cannot be recommended.—G. P. DARNELL-SMITH, Biologist.

Field Experiments with Sunflowers.

A COMPARISON WITH MAIZE FOR SILAGE.

Glen Innes Experiment Farm.

L. G. LITTLE, Experimentalist.

SUNFLOWERS were first grown on this farm for silage purposes in the season 1920-21, the primary object being to test them against maize. In the spring of 1921 some varieties were received from Grafton, and were sown in plots contiguous to the silage trial.

The land on which the plots were sown had been cropped with oats in 1920 and ploughed on 29th September, 1921. It was again ploughed in November, and then harrowed, and sown on 23rd of that month, the seed-bed being sodden but in fair order. The seed was sown through every fifth run of an ordinary Massey-Harris drill. For both the sunflowers and the maize, the rate of seeding was calculated at 15 lb. per acre in 35-inch rows, with 70 lb. superphosphate per acre.

The Season.

The rainfall for 1921 was 5,192 points, the winter, spring, and summer months being excessively wet, but with the new year a drought set in that has been considered one of the severest known in New England.

The wet winter and spring had delayed sowing, and the excessive December rainfall caused the ground to get out of condition, and when dry weather followed in January and February, maturity was hastened in a way that favoured the sunflowers. The growing period was just three months, and the rainfall was:—November, 95 points; December, 926 points; January, 192 points; February, 44 points. Total, 1,257 points.

Germination, Growth, and Harvesting.

The local sunflower seed germinated well, while that from Grafton and the maize germinated only medium well. Considering the lateness of the planting, the growth of the sunflowers was excellent, and at all times superior to the maize, which was rather backward. The maize in this experiment, which was the best of any in the experiment area of the farm, was affected by aphis, probably as a result of the moist weather in December. The sunflowers were not attacked.

Harvesting was done with the maize-binder on 23rd February. No difficulty was experienced, and beyond a tendency for the heads of the sunflowers to drop off when bundles are dropped there was no disadvantage as compared with the maize. The sunflowers were cut when in full flower, and the maize was at its best silage stage.

The Silage Results.

The yields of silage are presented in the following table:—

	Plot Yield.	Acre Yield.
Sunflowers (Mammoth Russian)	3,934 lb.	7 tons.
Maize (Wellingrove)	2,097 lb	3 tons 15 cwt.

The plots were 78 links x 320 links, approximately a quarter of an acre.

The result was definitely in favour of the sunflowers. The crop was between 5 and 6 feet high, even and attractive, and better than the maize in every way. As the previous year's silage proved that there was no difficulty concerning the palatability of sunflower silage, trials with this crop should be worth continuing.

Analyses were made by the Chemist, Mr. F. B. Guthrie, of samples of silage from the 1920–21 season's maize and sunflowers, and are worth quoting.

	Sunflowers		Maize	
Moisture		75·20		76·99
Albumenoids .	2·01 }	2·44	1·20 }	1·22
Crude protein, other nitrogenous bodies	0·43 }		0·02 }	
Ether extract		2·58		0·88
Ash		1·89		1·95
Fibre		11·85		12·75
Carbohydrates		2·59		2·83
Acetic acid		1·43		0·78
Lactic acid		2·02		2·60
		100·00		100·00
Albumenoid ratio		1 to 4·8		1 to 6·7
Nutritive value		14·3		9·4
Calculated to Dry Matter.				
Albumenoids	8·10 }	9·88	5·21 }	5·31
Crude protein, other nitrogenous bodies	1·78 }		0·10 }	
Ether extract		10·40		3·82
Ash		7·62		8·48
Fibre		47·74		55·41
Carbohydrates		10·44		12·29
Acetic acid		5·76		3·39
Lactic acid		8·16		11·30
		100·00		100·00

On this analysis the sunflower silage is much more nutritious than the maize, an added reason for further trials with the first-named crop.

The Variety Trial.

This section of the experiment was a failure, because the varieties had been cross-pollinated, and all sorts, shapes, sizes, and colours could be found in the plots. The Glen Innes seed was pure, but use will need to be made of the two-year-old seed to re-establish the strain next season.

The weights obtained from four rows of each, 320 links long, were as follows:—

Mammoth Russian (Glen Innes seed)	55 lb.
Mammoth Russian (Grafton seed)	55 lb.
White Beauty (Grafton seed)	50 lb

The growth of White Beauty for silage was far inferior to the others, the germination being poorest, and the plants weakest.

Mammoth Russian (Glen Innes seed) was best. The strain was imported from Montana in 1919, and seems very satisfactory.

THE CONSUMPTION OF WHEAT IN NEW SOUTH WALES.

THE Department of Agriculture is indebted to Mr. H. A. Smith, Government Statistician, for the opportunity of quoting the following from the "Official Year Book of New South Wales" (*in the press*):—

The quantity of wheat used annually as flour for human consumption has varied from 5 to 5¾ bushels of wheat per head in the past five years. . . . . .

The economy in human consumption of wheat as flour in New South Wales in the last three years has proceeded in two ways,—(*a*) in the actual quantity of flour consumed; (*b*) in the amount of flour manufactured from a bushel of wheat. These developments are apparent from the following table:—

Year.	Weight of Bushel of Wheat of fair average quality.	Average Amount of Flour manufactured from each bushel of wheat milled.	Amount of Flour consumed per head of population.	Amount of Wheat consumed as Flour.	
				Per head of population.	Total.
	lb.	lb.	lb.	bushels	thousand bushels
1918–19	62·5	40·4	230	5·7	11,400
1919–20	61·0	41·2	223	5·4	11,167
1920–21	59·5	42·3	211	5·0	10,538

In considering the relationship between the first two columns, it should be recollected that the average weight per bushel of wheat, shown in the first column, relates to the wheat grown in the season, such wheat not being available for milling until December; the returns of wheat-milling operations relate to the period July to June, and to a large extent therefore include particulars of wheat grown in the preceding season. Very little wheat grown in 1919–20 was available for milling. To some extent the wheat used for milling is selected.

It is apparent that the average amount of flour derived from the wheat milled has increased considerably, and that, at the same time, the consumption of wheat as flour has diminished very much. Despite a large increase in the population, the economy in the use of wheat so effected was very considerable.

Fodder Crops for Dairy Farmers.

Murrumbidgee Irrigation Area.

A. N. SHEPHERD, Inspector of Agriculture.

WHILE most dairymen will admit that they should be in the position to grow an abundance of feed for their stock, to be utilised as grazing, or to be cut and fed green to the stock, or to be conserved as silage or hay, very few practice the rotation of crops that is available for the settlers on the Murrumbidgee Irrigation Areas.

With irrigation water available, the settler is not dependent on the vagaries of the weather for the growth of his crop, although the great help obtained from rain is not to be belittled. An irrigation farmer is in the position that he should be able to sow when he wishes—not being dependent on rain to enable him to prepare a suitable seed-bed or germinate the seed after sowing. He should, therefore, always adopt short fallow practices and give his crop every chance.

Whilst the practice of grazing crops is not to be commended, much quick feed can be obtained by so doing. Sudan grass and millet in the warmer months, and oats, barley, or wheat (sown separately or as a mixture with vetches or field peas) in autumn and winter, produce crops that give quick returns in the shape of fodder for grazing.

If oats be sown early—say February—with a few pounds of Sudan grass, the latter will give early feed that will be followed by the oats when the weather is adverse to the growth of the grass.

We may roughly divide the sowing period into three, and still leave a few crops, such as millet and Sudan grass, to be sown when they are desired.

Starting with spring, maize can be sown followed by sorghum in December, and cereal sowing from the end of February to early April. When such sowings are practised a regular sequence of crops will be obtained and the work on the farm will be extended throughout the year, allowing of more time for the preparation of the land and for better farming generally.

The Crops.

Lucerne.—It should be the aim of every dairy-farmer to have some area of his land sown with lucerne. Admittedly this plant is the "king of fodders," and although very few of the farms classed as dairying blocks will grow it to perfection, even if lucerne will grow and give a return for a few years it is a payable proposition from the dairyman's point of view.

The best land on the farm should be selected for the growing of lucerne. The soil should receive a thorough preparation, be well graded, and check-banked to allow of quick and thorough watering, and also effectual drainage. The spacing of the check banks will be governed by the fall of the land, and they will vary from a half chain to a chain and a half apart. It is advisable to drill the seed, and whilst care should be exercised not to sow too deeply, the seed should be placed in the moist soil so as to give quick even germination. It is advisable not to harrow after drilling. Make a perfect seed-bed and do all the cultivating previous to seeding. The young plants in the drills will receive protection from wind and frost from the slight hilling of the soil between the drills. An addition of 70 to 112 lb. of superphosphate considerably assists the plants. When once the stand is established it can be much helped, and will last longer by careful treatment, such as adequate waterings, prevention of over-watering (which results in scalding of the plants), winter cultivation, and top-dressing with 1 to 2 cwt. superphosphate per acre.

It is advisable not to graze lucerne. If grazing is practised care should be taken not to do it when the land is wet, as this will at once destroy the plants, as well as do much injury to the soil. By making hay of the crop much danger in the way of hoven or bloat to stock will be avoided, and the cured product may be used with other fodders at other times of the year to provide the balanced ration that is so necessary if the maximum results are to be obtained from the cows.

Autumn sowings are preferable, as the land is then warm, a condition that favours germination, and allows the plant to make good growth before the hot weather comes, and before it becomes necessary to use irrigation water.

Maize.—This crop is especially suitable for the dairy-farmer. It gives big yields of succulent fodder, which can either be fed green or made into silage. As with other tall-growing crops, it is preferable to cut and feed maize rather than to graze it, in order to prevent a lot of waste. Under favourable conditions very good returns have been obtained by sowing with the ordinary wheat drill in rows 21 inches apart; but if the soil is at all dry or likely to dry out quickly, it is preferable to sow deep, using a maize-dropper for the purpose, sowing in furrows opened with a plough. Some farmers adopt the practice of broadcasting and ploughing under, and obtain good results.

Even when sown in drills it is advisable to "check-bank" the land every chain. This will allow of flood irrigation after the plants attain a height of 2 to 3 feet. Furrow irrigation having been previously practised, the furrows should be cultivated out to allow of farm machinery or carts passing over the land in harvesting. Superphosphate at the rate of ¾ to 1 cwt. per acre has been found advisable. Fitzroy is a variety that can be recommended Red Hogan, Yellow Hogan, or Ulmarra Whitecap also do well. For the greatest feeding value it is advisable to cut when the grain is glazing.

Sorghum.—With this particular crop it is advisable to sow with the wheat drill in rows 14 inches apart, and to seed at the rate of 14 lb. to 18 lb. per acre, using superphosphate at 1 cwt. per acre. The varieties recommended are Early Amber Cane for a quick grower, with Planter's Friend and Saccaline fer the main crop.

The great advantage of growing this particular crop late into the season is that it retains its succulence far into the cold months. It is a crop eminently suitable for the making of silage.

Care must be exercised in the feeding of sorghum to stock. The plant should not be utilised until the seed heads have appeared.

Oats.—In growing oats a quick maturing variety, such as Sunrise, should be sown. When seeding is carried out early, it will provide grazing for a lengthy period, and then give a good return in the form of hay. Sunrise should be sown at the rate of 2 bushels per acre. This is necessary owing to its weak stooling habit. Oats will respond to rougher treatment than barley or wheat, and also give heavier returns on the stiffer classes of soil Algerian is a later variety, but is a very heavy stooler, and gives hay of first quality.

Wheat.—The varieties of wheat to sow for early feed are Firbank and Florence. The former, being a light stooler, should be sown a little thicker. Under favourable conditions wheat makes rapid growth in the autumn and provides good grazing for the winter months.

Barley.—Such varieties as Cape, Skinless, and Trabut, if grown in the better class soils, give good results. Trabut, a variety new to the area, is hardy and produces good crops. Skinless is a very quick grower, but is badly affected by frost.

All these cereals are suitable for growing in conjunction with legumes which very materially increase their feeding value. The legumes most in favour for the purpose are vetches and Grey field peas.

Sudan Grass.—Although in former years this grass was grown rather extensively, it is not now so much in favour. If sown in the spring it will provide good grazing right through the summer and autumn. It is usually sown at the rate of 6 lb. to 10 lb. per acre through the wheat drill, either mixing with the fertiliser or through the grass-seed attachment.

The best results are obtained if the grass is grazed when it is about 2 feet high. During the hot months Sudan grass makes very rapid growth, as much as 5 tons of green fodder per acre being taken off at one cutting. Fertilising with superphosphate, at the rate of 70 lb. per acre, is advised.

Japanese Millet gives a quick return. It may be sown earlier in the spring than Sudan grass, germinating in a colder soil. Japanese millet, being a water-loving plant, responds to frequent irrigations.

Preparation of the Soil.

After reviewing the choice of crops at the disposal of the dairy-farmer, one other and most important point to stress is in the preparation of the seed-bed. By adopting a rotation a settler can give his land a short fallow between the various crops, which means much in the results.

The land should be well ploughed and worked down, and almost invariably irrigation should be practised previous to sowing, thus enabling the plant to make good growth before watering is necessary after germination.

Superphosphate greatly assists the crop, and dressings of 70 to 112 lb. should be applied.

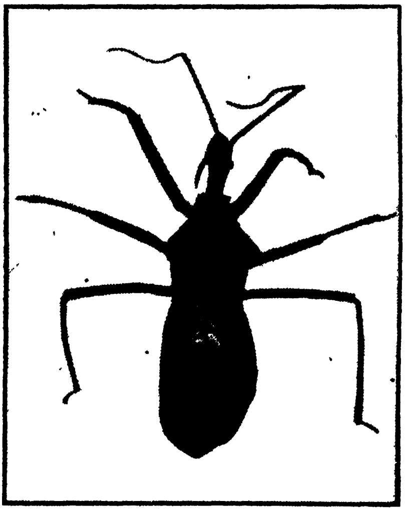
To assist in watering, it is also advisable to throw up "check banks" from half a chain to a chain and a half apart according to the land. This greatly helps in later waterings, and allows of a more even distribution of the water; in many cases prevents flooding and damage to much of the crop.

SOWING TABLE of Fodder Crops, Murrumbidgee Irrigation Areas.

Crop.	When to Sow.	How to Sow.	Quantity of Seed per acre.	Available for Grazing.	Available for Cutting.
Lucerne	April-May Aug.-Sept.	Drilled in rows 7 inches apart.	8 to 10 lb.	..	Sept.-June.
Maize	Sept.-Jan.	Drills 36 in. apart „ 21 in. apart Broadcast	20 lb. 36 lb. 56 lb.	.. ...	Dec.-May.
Sorghum	Sept.-Jan.	Drills 14 in. apart Broadcast	14 to 18 lb. 20 to 25 lb.	. ....	Dec.-July.
Wheat	March-May	Drills 7 in. apart	1 to 1¼ bus.	June-Oct.	Aug.-Nov.
Oats	Feb.-June	Drills 7 in. apart	1½ to 2 bus.	June-Nov.	Aug.-Nov.
Barley	Feb.-May	Drills 7 in. apart	1 bus.	June-Oct.	Aug.-Nov. (For green fodder only.)
Sudan Grass	Oct.-Jan.	Drills 36 in. apart „ 7 in. apart Broadcast	6 lb. 10 lb. 12 to 15 lb.	Nov.-May	Dec.-May.
Japanese Millet	Sept.-Jan.	Drills 7 in. apart Broadcast	10 to 15 lb. 15 to 20 lb.	Nov.-May	Dec.-May.
Field Peas and Vetches	Feb.-June	Drills	Alone, 60 lb. With cereal, 30 lb.	June-Nov.	Aug.-Nov.

AN ENEMY OF THE BEE.

QUITE a number of insects may be regarded as enemies of the bee, and one of them is the carnivorous plant bug shown in the illustration. This, popularly known as the Assassin bug, captures its prey more by the exercise of cunning and stealth than by its wing-power. Hiding about the flowers, it attacks its victim while the latter is busy gathering the nectar. At times, one sees the bugs about the hives, giving the impression that they are on the lookout for bees returning from the fields. The Assassin bug has a curved trunk, which it uses to extract the juices from the captured bees. It develops by a series of moults, and numbers of the insects at the smaller stage are at times found near the hive entrances in the act of extracting juices from dead and disabled bees. Care should be taken if the bugs are handled, for practically all species can sting or bite very severely. It is needless to say that such pests should be destroyed at every opportunity. These bugs are principally found in the coastal districts.—W. A. GOODACRE, Senior Apiary Inspector.



Recent Changes in Artificial Fertilisers.

In recent articles in several different journals, Dr. E. J. Russell, Director of Rothamsted Experiment Station, has drawn attention to changes that have taken place in regard to the artificial fertilisers used by farmers in Great Britain. In the meantime these changes are of significance to Australian farmers in only one aspect, but they are such as we should be cognizant of because the day may come when their bearing upon farming here will be important.

Probably the most important change, and one that will ultimately be for the good of the world (as Dr. Russell says in one of these articles) is the enormous increase in plant for making nitrogenous fertilisers from the air. The production of such fertilisers had commenced over fifteen years ago, and by 1914 German chemists had worked out a method beautifully simple in principle (though hardly so in practice), and workable in any country. The nitrogenous compounds so obtained were easily converted into high explosives, and so the first fruits of the discovery was a devastating war. That being ended, fertilisers for crops are again receiving attention from these factories, and it is now estimated that the world is capable of manufacturing 7,500,000 tons of sulphate of ammonia annually, and there does not appear to be any reason why the figure should stop there or at any multiple. The European farmer, however, is quite embarrassed by the situation, for no fewer than seven new nitrogenous fertilisers are now available, for each of which there is something to be said on the ground of cheapness or of some special utility. Agricultural experiment stations are likely to be busy with them for some time, as the proper way to handle each of them has still to be learned. The question is in what form is the farmer going to apply nitrogen to his crops—as nitrate of lime, cyanamide or nitrolim (though both of these have been known for some years), as muriate of ammonia, urea, nitrate of ammonia, carbonate of ammonia, or as guanidine?

The changes in relation to phosphates, though great, are not of the same kind. Before the war British farmers were accustomed to the basic slag produced in the making of steel by the Bessemer process, but during the war the steel-making processes changed, and the new methods do not give such a useful slag; instead, the slag is of poorer quality, and it is of two different kinds—one being nearly as rich in soluble phosphates as the old Bessemer slags, and the other not nearly so good. Experts have had no time to investigate these two slags in relation to crop-production, and evidently farmers in older countries will have to accommodate themselves to new ideas in connection with these phosphatic mediums, as they will have to in relation to the nitrogen-bearing ones.

In connection with potassic fertilisers, Australian farmers are more familiar with the changes wrought by the war. The pre-war potash came from Stassfurt in the form chiefly of sulphate of potash. Present-day potash comes very largely from the deposits in Alsace that have now come into the hands of the French, and until latterly have been chiefly in the form of muriate of potash. The change may appear simple, but agricultural chemists know it to be really complex in its significance to farmers. It may well happen (and often does) that the two fertilisers have approximately the same value, but in other cases one or other may prove somewhat superior.

Thus in all three classes of fertilisers there have been changes during and since the war. Those changes will no doubt ultimately be of benefit to farmers, but exactly in what way has yet to be learned.

As already stated, Australian farmers are only immediately concerned with one—that connected with potash—but all of them are worth watching.

"FLOUR STRENGTH" AND "PROTEIN CONTENT."

IT is of some importance to remember that the terms "flour strength" and "protein content" are by no means synonymous. It is possible to have a wheat yielding a highly nutritious flour that will not make well-risen loaves in the bakehouse. The greater part of the gluten, so valuable in breadmaking, is distributed among the starch cells of the grain. By close milling we may get a flour with a greater percentage of protein, at the expense of the colour, but it will be of no advantage to the baker. Some observations by Dr. Hargreaves, of the South Australian Department of Agriculture, in the July issue of that Department's journal are interesting in this connection:—

"The largest baking company in the world, the Ward Baking Company, of New York, has this year given up the use of white flour entirely, and adopted what the company terms 100 per cent. whole wheat flour. As this company produces about 100 tons of bread per day, and has about 17,000 distributing agencies, it will be evident that it is actuated by no mere fad . . . The protein of both bran and pollard is generally higher than 14 per cent., whereas the standard for flour, under the food and drugs regulations, is only 7½ per cent."

It may appear to the general reader that the attention given to flour strength is misplaced if one can secure a sufficiently nutritious product by milling the entire grain in the case of a soft flour variety. It is true the resulting flour would have a higher percentage of nitrogenous matter, but there would be no improvement in the bread making qualities. It is safe to say that the above-mentioned firm could not make their output of bread working on Federation wheat—the flour would have to be considerably stronger. It seems likely that the public will in time become educated to appreciate the whole wheat bread, when it is milled finely enough and not put out in the form of whole "meal" bread as we get it to day. The dark colour should not be an insuperable objection, though we have not had "war bread" to pave the way for such an innovation.

The time may come, as Dr. Hargreaves suggests, when bran and pollard, as now manufactured, will be off the market, and their place will be taken by inferior wheat and screenings reduced to "meal." This will mean a much more nutritious flour for the consumer, but such flour, especially in machine bakeries, will require to possess a very fair strength to make well-piled loaves when baked. All of which points to the fact that the breeder cannot afford to aim at increasing the wheat yield without due regard to the flour strength in the varieties concerned.—J. T. PRIDHAM, Plant Breeder.

The Soils of the Murrumbidgee Irrigation Areas.*

HOW TO DEVELOP THEIR CAPACITY FOR FRUIT PRODUCTION.

H. J. BRAUND, District Inspector, Water Conservation and Irrigation Commission, Leeton.

THERE are two great divisions in the business of fruit-growing—the first is production and the second is marketing. In the following pages it is proposed to throw as much light as experimental data and personal observations will permit on the fundamental question of production, starting with the foundation of the soil itself and building upwards.

It is amazing how little the average settler knows of the nature of his own soil. By this term is not meant merely the small superficial layer which the barnyard hen scratches, but that vast mass of potential and actual plant-food enclosed within his boundary fence and 6 feet in depth. Though one says 6 feet in depth, our soils are of practically unlimited depth, but fruit-trees on the Area, except in isolated cases, will not profitably use and fully occupy with their roots soil to a greater depth than 6 feet. Until the average settler acquires a fuller understanding of the simple factors of fertility, plant nutrition, and the basic principles underlying maximum plant growth under irrigation in a semi-arid belt like the Murrumbidgee Irrigation Areas he will continue to flounder and grope after success like a blind man trying to view a beautiful picture through field-glasses. The picture unmistakably in my vision is one of great beauty and enormous production. The average picture is unfortunately very different. Some men complain of the inability to increase yields, others of fruit getting small and the quality deteriorating. In some instances odd trees are dying after attaining several years of age, in others vines have wilted seriously during hot spells, while again some men have grubbed out peach-trees only nine years old as having spent themselves, and so on. Visiting experts have often given formidable names to some of these maladies, but none, as far as I know, have attacked the real cause. It is like a surgeon treating the symptoms of a malignant disease while ignoring the cause. If I had to describe the real cause of practically the whole of our production troubles in two words I would unhesitatingly say—shallow rooting.

Our Soil in its Native State.

Although the soils of the Areas are of alluvial formation, they differ from the commonly known "alluvial flats" of our rivers only in age. The river or watercourse which formed these Areas has ceased to exist ages ago, and the soil has been gradually compacting and more or less lying dormant ever since until natural agencies have gradually changed them to their present condition. The average rainfall spread over countless years being comparatively low has only penetrated to a very shallow depth and has carried down with it in solution or suspension many of the natural soil cements or colloidal compounds which have accumulated below the surface to form what are usually termed "hard pans." These hard pans are more or less impervious to the downward movement of water and roots, and consequently the average fruit-tree is only able to feed in the soil immediately overlying this hard pan or densely compacted strata; hence the existence of a shallow and painfully restricted root system on all such soils which have not been suitably improved so as to destroy this impervious layer. One is speaking now, be it noted, only in averages, being quite aware that some soils are not worth improving for intense culture, and that considerable areas, on the other hand, of unusually rich and deep soils only need organic matter to make them nearly ideal. We are in the position of pioneer intense-culturists for whom it is necessary to carry out certain specific foundation work with the soil before it is in a state of commercial productivity for such culture. Our soil is like unrefined gold or a diamond of enormous value in the rough. Prepare this great potential mass of wealth in the proper manner, and then whatever crop it is that you wish to grow, providing it is suitable to our district, it will yield to a degree that is really worth while.

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* Paper read before members of the Griffith branch of the Agricultural Bureau, June, 1922.

The Elements of Fertility.

Although some things mentioned here can be read in certain agricultural works, I have found from my eight years of daily experience on these Areas that many men have not the ability to apply theoretical principles to specific practical problems. For instance, perhaps most settlers know from mere reading matter that fertility depends on the degree of and perfection of their soils, (1) physically, (2) chemically, and (3) biologically, but when they are faced with the actual condition of their own particulur soil, they are at once puzzled. Chemically speaking, and with regard to plant foods in particular, our soils are excellent. They contain (in the case of an average loam) in the surface 4 feet—

Nitrogen at the rate of 2 tons per acre
Phosphoric acid at the rate of 8 tons per acre.
Potash at the rate of 26 tons per acre.
Lime at the rate of 35 tons per acre.

The chemical constituents are not exactly balanced, but for a foundation on which to work, and as soils go, it is faultless. As might be expected from the above analysis, and bearing in mind that most of this plant-food is not in a water soluble condition, we have obtained definite increases in yields by additions of superphosphates and of nitrogen both in its organic form as blood and bone and as sulphate of ammonia. The manurial problem, however, is so simple of solution by actual experiment in each individual case, that further than stating that the proper function of manuring can never be attained until the subsoils are put right physically, one may hasten on to the greatest and only real problem—that of faulty substrata. It is faulty substrata which causes shallow rooting, hence reduced feeding area for the roots, hence reduced yields, poor quality of produce, and a host of symptomatic maladies that are being accepted, one is alarmed to note, almost complacently by many settlers as being natural to our particular conditions of soil and climate and beyond control or cure. It is just as reasonable to complain because diamonds are not mined already cut and polished, or that the attractive auriferous element will not come from the bowels of the earth already stamped for the bank. Tradition, rule of thumb, and conservatism have had such a grip of agriculture, that when a slightly different problem is met with, instead of calling in our ally, agricultural science, we simply cry " wolf." Faulty substrata, let it be repeated, is our only real problem. This problem is not even realised by many, and it is not squarely faced by many who do vaguely know of its existence ; but a small number of men have not only faced it, but have solved the difficulty, and are substantially profiting thereby. The third, the biological element of fertility, has not yet been dwelt on, because personal experiments have proved to me beyond all doubt that once the physical condition or texture of the substrata is corrected, and organic matter is incorporated in the soil mass, the requisite bacteria quickly become vigorous and efficient. These experiments have shown that the spores of the various bacteria are lying dormant in the soil, waiting for the ingenuity of man to give them life by admitting congenial fresh air, moisture, and organic matter.

Faulty Substrata and its Correction.

Realising that the root system of a plant is the machinery by which practically all of the raw materials except carbon, which make the finished product in the form of fruit, leaves or twigs, &c., as the case may be, are absorbed, it necessarily follows that for a large output above ground there must be a correspondingly large root system underground. Not only so, but this deep and extensive root system must be in first-class working order, adequately supplied with moisture and plant-foods, and the soil must be in such a condition as to texture that the roots may penetrate and permeate it easily and quickly and have ample room for expansion. It was found by mechanical analysis and also by microscopical examinations of the soil structure that in certain soils that were slightly moist even to 6 feet the roots were only actually feeding to a depth of 1 foot, the reason for this being, it was quite apparent, that the roil was too close-grained and tightly compacted for the roots to penetrate and feed. The substrata was found to be of single grain formation instead of in compound grain clusters, commonly known as crumb structure.

We know that crumb structure is essential in such a soil in order to permit air and water to penetrate freely enough for rapid growth, Rapid and prolific growth conditions are the essentials of big yields. Furthermore, we know that crumb structure can only be maintained by an adequate supply of organic matter in the soil. The definite problem is therefore this: Our trees are rooting shallow and horizontally in the surface foot (more or less) and are yielding and behaving generally as the starved and stunted conditions of the root zone would quite naturally make them. By the time 4 inches of surface soil is taken away from them by ploughing and cultivation, thousands of our trees and vines are actually depending upon 8 inches of moist soil. Is it not one of the wonders of nature that we have done so well as we have in the way of yields obtained? We want, then, our trees to root freely and feed rapidly in the surface 4 feet of soil at least. We know that crumb structure throughout this 4-foot mass is essential, and to maintain it we have to incorporate organic matter. Our only payable way of getting this organic matter into this 4 feet is by the growth of deep tap-rooting crops. In order to get large amounts of organic matter we need the maximum growth possible in the soil-improving crop and we have to find a plant with a tap-root capable of penetrating the hard pan and faulty substrata. In the last respect I only know of two such plants suitable in all respects, they are lucerne and Bokhara clover.

Root Systems—An Index of Soil Texture.

Let the foregoing arguments now be repeated in somewhat different language and metaphor. One cannot stress a valuable truth too much. The manner in which roots grow in the soil is a reliable indication of the soil's condition generally. Roots of trees, lucerne, clover, &c., on these Areas are found to vary in very definite ways, according to the class of soil in which they have grown, and in connection with soil investigation experiments I have found roots to be a trusty guide. Roots may be short and tapered, horizontal or vertically inclined, fibrous or comparatively bare, free growing and healthy, or pinched and stunted and of starved appearance generally, and so on. In many cases where I have been in doubt as to the precise effect of a certain soil treatment I have been able to find the answer in the root system. Generally speaking, the problem has been to make the soil conditions such as will induce the roots to adopt more of a vertical tendency, and to develop a greater degree of fibrils and feeding terminals and to travel to a much greater depth.

Soil Moisture and Soil Texture.

Hand-in-hand with the close study of the rooting habits of plants in certain faulty soils, the capacity of such soils for water must be carefully studied. By digging small shafts a day or two after irrigation the movement of the soil water may be plainly discerned. If free water is held up at any point through faulty substrata, particularly in the zone occupied by roots, death or injury to many roots will result. This prevents maximum root development and hence maximum yields. I have determined that for apricots and peaches seventy two hours is sufficient to give a severe check to growth by means of a supersaturated soil in the root zone in the summer months. Free or gravitational moisture in the root zone is the enemy of maximum yields.

Therefore, unless the surface 6 feet of soil is sufficiently porous to permit the free downward movement of all moisture in excess of the maximum capillary point it must be classed as faulty for irrigation purposes under our conditions. Of the 6 feet of soil mentioned, 4 feet should be actively occupied by healthy feeding roots; the 2 feet underneath the 4 feet of root zone should serve as an overflow reservoir for misjudgment in applying irrigation water. As it would require about 24 acre-inches to the acre to fill up the whole of the 6 feet to the capillary saturation limit in an average soil in good condition, there would be an ample margin of safety in applying water.

Only Life can Produce Life.

A fertile soil is a balance between the organic and the inorganic elements. No soil can be fertile with either element missing, or either element below its correct proportion. It is the natural balance necessary between the inorganic chemical elements and the bacterial and organic. The bacterial balance depends upon the degree and state of the organic or decomposed vegetable matter in the soil, and the continuity or permanence of capillary moisture and fresh air. Fresh air and ample organic matter and permanent capillary moisture depend upon the physical state of the soil, or in other words, its texture. If any one or more of the foregoing elements are absent, or deficient in any particular soil, just so much will that soil fall short of its capacity for maximum production.

The presence of all these elements in their right proportions is what may be termed the symmetry of fertility—a fertile soil is a "live" soil, and one with a generous supply of decomposed organic matter and humus. A soil can only be fertile or highly productive when it is filled with teeming millions of bacteria. Only life can beget life. The bigger the life within the soil the larger the life it is capable of producing above ground in the form of fruit, &c. In soils with faulty substrata 1 foot from the surface there is life only in a thin or shallow zone of a few inches. A small life can only beget a small life. A Shetland pony cannot produce a draught horse. To breed big trees and huge crops the parent must be there. The parent should consist of the 6,000 tons of fertile soil, 4 feet deep, over every acre. Never forget that the amount of fertility underneath determines the amount of productivity on top. It is one of the natural laws in the balance of nature.

Nature's Chemical Factory.

It is a fact not generally appreciated that the most efficient and valuable chemical agency in disintegrating hard pans and loosening up faulty substrata is the root system of deeply penetrating tap-rooted plants. By reason of the killing and decomposition of a suitable root system *in situ* in the soil certain organic changes are effected in the roots through bacterial agency whereby nitric acid is produced in addition to other chemical compounds which have a valuable flocculating effect on the soil colloids, and by further chemical interaction convert basic nutrients into available plant-food. Decomposing organic matter in the soil is nature's cure for her own faulty soil formations. Decaying organic or vegetable material means a veritable chemical factory within the soil, incessantly manufacturing carbonic acid, ammonia, nitric acid, &c. The bigger the factory the larger the output of these chemicals, therefore the more roots and vegetative materials incorporated the more nitric acid, &c., produced, and the more completely will faulty substrata be converted into mellow congenial soil. I do not believe that any *inorganic* chemical treatment can ever, by itself, bring about similar results.

Subsoiling Experiments.

Using lucerne as an indicator crop, extensive experiments carried out at Griffith prove that subsoiling to a depth of 2 feet to 2 feet 6 inches with a well-known pattern of power subsoiler substantially increases both the vigour of the root system and also the yield of fodder; it at least doubles it for the first two years. We find that although the actual hard pan is not reforming after two years of irrigation the penetration of water is nevertheless not so rapid as at first. Examination after watering reveals the fact that the cause of the water penetration slowing up again is attributable to a colloidal film, the texture of the soil otherwise being undoubtedly improved. We find therefore that subsoiling is distinctly beneficial to plant growth, but that on account of this operation failing to convert the soil colloids in the soil into a crystalloidal state this inherent gluey nature still persists to the detriment of maximum yields. We have fortunately already proven by other soil improving experiments (notably on Farm 220, Mirrool Area, over a 22-acre test field) that the application of 90 per cent. gypsum has the effect of converting at least a large proportion of these objectionable soil colloids into crystalloids. By the application of gypsum alone in these experiments without subsoiling or any other treatment we were able to increase the water absorbing capacity of this particular soil from 1¾ inches to 6½ inches, and by extending the treatment to the ploughing-in of the lucerne crop after the roots had penetrated to 6 feet, a further test revealed that the water capacity was increased to 11¼ inches. The carbonic acid, ammonia, humic acid, and nitric acid generated in the process of decomposition of the lucerne roots had further disintegrated the colloids, made plant-food available, and made more air space in the soil.

On some soils ½ ton per acre of gypsum will soften the hard pans, and in other types 2 tons is necessary. From the various experiments which I have been conducting for the past eight years I hold the opinion that any soil that requires more than 2 tons of gypsum to convert its colloids is not fit for irrigation purposes and should not be regarded as suitable for intense culture, for although such a soil could be made highly fertile, the cost would be so high as to make it unprofitable to do so. It should be stated here that fruit-trees planted two years ago in soil treated as above are already rooting freely down to 3 feet where previously the effective root zone was within the surface foot even at 7 years of age. It will now readily be seen that experiments of the last eight years prove that for lands with faulty substrata and not yet planted to trees, subsoiling, gypsum, and the growth and decomposition in the soil mass of a deep rooting crop functionally similar to lucerne (if it is not desired to grow lucerne) will effect a very marked improvement in productive capacity.

If a settler can only afford one of the three operations I would say select the tap-rooting crop, but in that case I would recommend Bokhara clover as being hardier than lucerne; moreover, being a biennial, it dies a natural death after two years of growth. I have in my possession specimens of Bokhara clover roots that have burst through very tough cement hard pan by means of their powerful tap-root and that penetrated 5 feet in depth in twenty-three months from time of sowing.

To Renovate Established Orchards.

To renovate the soil of established orchards, gypsum in conjunction with Bokhara clover is the remedy. With regard to gypsum the object that must be attained is to get it all into solution as quickly as possible, because it is only in water solution that it has any effect on the gluey compounds of the substrata. If gypsum is only applied on the surface of the ground it is likely to remain there, particularly throughout the dry summer months, and be quite inert. Gypsum must be incorporated in the soil at such a depth as to be in the permanently moist zone and that means below the depth at which the cultivators work. This point is very vital and failure to observe it has caused disappointment to people who should have known better. A good plan is to plough as deeply as possible with the single-furrow plough, and to shovel the gypsum into the bottom of the furrows, following behind the plough with cart or dray. If the job is worth doing at all, it is worth doing in such a manner that the fullest possible benefit will be derived from the chemical interaction. Immediately the soil dries out below the capillary moisture point, the action of gypsum will cease until moisture is restored, either by sufficiently heavy rain or irrigation. Gypsum is not under any award or union rules, and is willing to work twenty-four hours a day. It only stipulates continuous moisture. It should be applied as long as possible before sowing time for Bokhara, because one then obtains a bigger root system in the Bokhara and a more vigorous plant generally, with a correspondingly increased degree of all-round benefit to the substrata. One gets more secondary roots and fibrils, which are so valuable in pushing apart the soil grains and assisting in forming the compound or multiple grain crumb structure. The largest possible root development should be made a *sine qua non*.

The orchard land should, of course, be perfectly graded, and on clay loams six permanent furrows with a 22-feet-square system of planting must be opened up, evenly spaced from tree to tree, to facilitate the process of providing adequate water for both the fruit trees and the soil-improving crop. The practice of growing maximum green manuring crops in established orchards is an art in itself, although the actual operations involved are of the simplest nature. A lot could be written from our accumulated local knowledge of green crops and methods of successfully growing them. Personally, I prefer sowing Bokhara clover broadcast at the rate of 14 lb.

to the acre through a "cahoon" broadcasting machine, in soils where the available root moisture is only stored in the shallow surface zones up to 1 foot in depth. I have many good reasons for recommending March as the safest time to sow. Those who are harvesting in March must needs sow later in the autumn, but whenever it is done nothing should be counted too much trouble if it guarantees a good vigorous strike.

Cost of the Treatment Recommended.

The financial aspect of the foregoing soil improvement methods will show an actual credit instead of debit right from the very start. The cost of applying even 2 tons of gypsum and establishing a good stand of Bokhara clover would not exceed £10 per acre. As against this and by reason of the Bokhara occupying the whole of the ground not taken up by the actual fruit-trees themselves, no further ploughing or cultivation is possible for two seasons. Watering only is necessary. It is quite certain that extra or more frequent waterings are necessary during the hotter months, but the saving in cultivation work generally would, I should say, be about £15 per acre. Thus one shows a profit of £5 per acre on the two years' operation, and, what is of the most vital and fundamental importance, the productive capacity of the orchard would assuredly be more than doubled and future working expenses, by reason of the fewer irrigations required, cut in half.

Finally, the various symptomatic troubles now experienced by reason of the tortured tree striving to make both ends meet by being forced virtually to live on top of the farm instead of deeply within it, will automatically cease to exist. A deep-rooted tree is not worried with the excessive heating up of the 1 foot of surface soil nor untimely wilting in the height of the summer months, because nine-tenths of its roots are out of reach, luxuriantly and safely ensconced within the deep well of fertility where, under our conditions, nature intended they should be.

A MISAPPREHENSION ABOUT COTTON.

It has been stated from time to time that cotton can be grown on inferior land, but such statements are not according to the facts. Cotton requires good soil and will not produce a satisfactory yield of good quality on poor land. The cost of picking is the most important item in the production of this crop, and if the yield and quality of the cotton are poor the profit is reduced, less cotton being picked and the cost of picking being proportionately greater in relation to the price obtained. Indeed, poor cotton may cost more to pick than it is worth.

The growing of cotton should not be attempted on any land which will not produce at least 40 bushels of maize under average conditions. Intending growers of cotton are advised to sow only a small area of the crop to commence with—say half-an-acre for the first year, so that they may judge whether they will be able to provide the labour required in picking.—A. H. E. McDONALD Chief Inspector of Agriculture.

Farmers' Experiment Plots.

GREEN FODDER TRIALS, 1921-22.

Murrumbidgee Irrigation Areas.

A. N. SHEPHERD, Inspector of Agriculture.

THE following farmers co-operated with the Department during the above season in the carrying out of green fodder trials:—

W. Edwards, Farm 367, Leeton.	R. Farrar, Farm 798, Gogeldrie.
T. Johnson, Farm 388. Leeton.	Todd and Beveridge, Farm 52, Leeton.
P. C. Moran, Farm 802, Leeton.	H. Booth, Farm 854, Whitton.

The Season.

Low temperatures were recorded in the spring, resulting in many cases of poor germination, and more especially with Sudan grass. The rainfall was below the average, the registrations at Leeton being as follows:—October, 119; November, 21; December, 172; January, 64; February, 62; March, nil; April, 280.

It will be seen that the falls during the autumn were very light, with the exception of the month of April, when nearly 3 inches were recorded, but of this 2½ inches were registered in one fall of twenty hours. Needless to say, this fall was too late to assist the crops under review. The evaporation from a water surface for the months October to April, inclusive, was 44·686 inches.

The crops experimented with were maize, sorghum, and Sudan grass.

The Plots.

Farm 367.—On this farm a manurial trial with Fitzroy maize was carried out. The soil consisted of a heavy red clay that was fallowed in June, ploughed in August, double-disced and harrowed in September, sown on 29th September with double maize-dropper at the rate of 20 lb. seed per acre. The crop received water in October, November, December (twice), and early January, when it was cut and weighed.

Farm 388.—A variety trial with maize was conducted on red clay soil. The land had grown lucerne in previous years. It was ploughed in June, double-disced and harrowed in September and October, smoothed in October, and sown at the rate of 20 lb. per acre with 70 lb. superphosphate. Only fair germination was obtained, owing to some of the seed having been damaged by weevil. The crop was irrigated in November, December, and January.

Farm 802.—Two trials were conducted—one with maize, sown in the spring, and the other with sorghum, sown in the autumn. The maize was sown as a rate-of-seeding test, the various plots being sown as follows:—

(*a*) 20 lb. per acre, rows 35 inches apart.
(*b*) 36 lb. per acre, rows 21 inches apart.
(*c*) 56 lb. per acre, rows 7 inches apart.

In all cases 70 lb. of superphosphate were applied.

The soil was of a red sandy loam. All plots were sown with the **Mitchell** wheat drill on the 4th October, 1921. A very good germination was obtained, and the crop made good growth. The maize was cut and weighed on 17th January, 1922. The thinner sowing grew the tallest crop, but it was also the coarsest. The best sample of fodder was obtained from that sown 21 inches apart, and it may also be mentioned that this gave the heaviest return. The plot sown in 7-inch rows, although very fine in the stalk, did not produce cobs, and it was also noted that this burnt off with the hot winds. The crop was irrigated twice—during the months of November and December.

The sorghum plot on this farm consisted of a manurial trial with Saccaline, sown on 22nd December, 1921, on red loam at the rate of 15 lb. per acre. The land was ploughed in October, double-disced and check-banked in November, and irrigated previous to seeding. Very good growth followed a fair germination. The crop received water at each rotation, and the green fodder was cut and weighed on 2nd May.

Farm 798.—A variety trial with sorghum was carried out on grey soil. The land had been well prepared, and was sown on 18th November with seed at the rate of 14 lb. per acre and superphosphate 70 lb. The plot received a watering previous to sowing. A very good germination was obtained, but the crop was badly attacked by grasshoppers. An irrigation was given at the beginning of December, and the eaten down plants made a good recovery and came away quickly. A plot of Saccaline, grown from pure seed obtained locally, was sown alongside this trial, and gave the heaviest returns. The plot received water at each rotation, that is, fortnightly.

A new variety—Orange sorghum—was grown for the first time in these plots, and gave promise of being very suitable for the district. It gave a heavy yield of fine stalks, containing an abundance of sap that was exceptionally sweet. It was very noticeable that this variety was not nearly so badly infested with red stain as the other varieties in the trial. It is hoped to have further trials with this variety during the coming season.

Farm 59 —On this farm a manurial trial with Sudan grass was carried out. The soil was a red clay loam. The seed was drilled in on 3rd October, 1921, at the rate of 10 lb. per acre, splendid germination and growth followed. On inspection, on 28th November, it was found that the crop had been eaten right to the ground by grasshoppers. The plot was then irrigated, and the grass cut on 5th January. During the period it had received in all four waterings. For the rest of the season the plot was used as a grazing proposition, the following stock being depastured on it:—

Ten head of cattle and five horses on 4 acres as indicated—

From 8th January, 1922, to 16th January, 1922, for 2 hours per day.
„ 16th February, „ „ 6th March „ „ 3 „ „
„ 12th March, „ „ 3rd April „ „ 4 „ „
„ 7th April, „ „ 14th April „ „ 4 „ „

Farm 854.—An area of 5 acres was sown with Sudan grass at the rate of 8 lb. seed per acre, with 70 lb. superphosphate, on heavy red land. On 20th September, 1921, a good strike was obtained, but, in common with many other crops on the area, this also suffered as a result of the grasshopper pest in November.

The idea of this plot was as a grazing and carrying trial. The following figures were obtained:—Thirty-three head cattle, grazing 27th to 30th November, 30th December to 13th January, 29th January to 12th February, 1st to 16th March. The crop was watered between the grazing periods, and in each case the grazing was for two hours per day.

The Yields.

FARM 367.—Fitzroy Maize.

	t.	c.		t.	c.
Blood and bone, 2 cwt. per acre	11	15	Superphosphate, 2½ cwt. per acre	9	18
P7, 2¼ cwt. per acre ...	11	8	Superphosphate, 1¼ cwt. per acre	9	16
M5, 1⅞ cwt. „ ...	10	15	No manure	7	11
M6, 2 cwt. „ ...	10	6			
M7, 1⅝ cwt. „ ...	9	19			

FARM 388.—Variety Trial Maize.

	t.	c.	q.	lb.		t.	c.	q.	lb.
Hawkesbury Hogan	8	16	3	4	Ulmarra Whitecap	7	3	2	12
Yellow Hogan ...	8	12	3	12	Cooke's Prolific ...	7	0	1	12
Fitzroy	7	16	3	20	Narrow Red Hogan	6	18	3	7
Large Red Hogan...	7	5	1	20	Leaming	6	14	3	4

FARM 802.—Maize Seeding Test.

	t.	c.	q.	lb.		t.	c.	q.	lb.
21 inch rows, 36 lb. seed	13	17	3	16	7 inch rows, 56 lb. seed	12	16	2	4
					3 feet, 20 lb. seed	12	4	3	14

Saccaline Sorghum Manurial Test.

	t.	c.	q.	lb.		t.	c.	q.	lb.
M6, 1 cwt. per acre	23	14	1	16	No manure per acre	20	7	3	2
M5, 105 lb. „	32	5	2	0					

FARM 798.—Sorghum Trial.

	t.	c.	q.		t.	c.	q.
Saccaline (local seed)	27	15	1	Saccaline	22	1	2
Orange sorghum ...	27	13	2	Early Amber Cane ...	16	4	2

FARM 59.—Sudan Grass.

	t.	c.	q.	lb		t.	c.	q.	lb.
Superphos, 70 lb. per acre ..	2	2	3	0	M7, 91 lb. per acre	1	13	3	20
Superphos., 14 lb. per acre ...	1	19	3	23	M5, 105 lb. „	1	13	1	1
M6, 1 cwt. per acre	1	14	1	4	Blood and bone, 1 cwt. per acre	1	13	0	4
P7, 1⅛ cwt. „	1	13	3	26	No manure ...	1	8	2	8

The mixtures used are made up as follows:—M5—2 parts superphosphate, 1 part sulphate of ammonia. M6—5 parts superphosphate, 3 parts chloride of potash. M7—10 parts superphosphate, 3 parts chloride of potash. P7—equal parts superphosphate and bone dust.

Insects in Dried Fruits.

EXPERIMENTS IN STERILISATION FOR THEIR CONTROL.

K. C. McKEOWN, Water Conservation and Irrigation Commission, Leeton.*

HAVING at various times carried out experimental work on a small scale in connection with the control of insects infesting dried fruits, the suggestion, in November, 1921, of the Murrumbidgee Irrigation Area Co-operative Company, Limited, that a series of experiments in the sterilisation of dried fruits with the extensive plant then in course of erection was a welcome one, as it afforded an opportunity, not only of adding to the information already in my possession regarding methods of control of insect pests of dried fruits, but also of carrying out the necessary experiments with a maximum capacity plant constructed on a commercial scale. The majority of the previous work in this connection had been carried out on a small scale, and usually with a laboratory incubator, which greatly reduced the value of the experiments.

Reference to the existing literature on the subject proved that little information was available with reference to sterilisation of dried fruits, &c., by means of moving heated air. Most of the authorities referred to dealt generally with the effects of heat on insect life, but few, if any, gave details, and where particulars were given they were incomplete and wanting in essential data. The temperature at which heat becomes fatal to insect life appeared to be only vaguely known. The Institute of Science and Industry gave valuable assistance by supplying a summary of the information then available on the subject; and this summary, although supplying no complete data, yet provided a valuable basis on which work might be commenced.

The Dehydrating Plant.

A few details as to the plant used in these sterilisation tests will be of interest. The information was kindly supplied by Mr. G. Vincent, Darlinghurst, who invented the plant.

The design provides for the complete dehydration of all classes of fruit, including apricots, peaches, prunes, lexias, sultanas, currants, and pears. The plant may be briefly described as consisting of four parts:—(*a*) Twin centrifugal multivane fans; (*b*) double direct-fired air-heating furnaces; (*c*) transverse air duct with central breeching-piece and main central valve; and (*d*) twin parallel tunnels, to which the transverse air duct connects at each end.

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* Thanks are due in connection with the work for the valuable assistance afforded by Mr. Geo. Vincent, inventor of the dehydrator installed, and by Mr. A. E. Cook, Manager of the Murrumbidgee Irrigation Area Co-operative Company Ltd. Mr. G. Evatt, Resident Commissioner, enabled me to devote considerable time to the experimental work by generously releasing me from other duties.—K. C. McK.

The capacity of the fans used ranges from 36,000 to 48,000 cubic feet per minute, varying with the resistance set up in the tunnels by the different classes of fruit assembled on the trays and the number of trucks placed in the tunnels. The capacity of the furnace is 3,600,000 British thermal units per hour, working under ordinary average conditions as to firing and average quality of wood fuel used.

The sectional area of the transverse air duct, 7 feet 7 inches high by 3 feet wide, is equivalent to the sectional areas of the fan discharges, and is so proportioned as to bring the velocity head of air, after passing through the interior of the furnace, back to normal velocity head and pressure.

The capacity of the two parallel tunnels is equal, each providing for eleven trucks being run into each tunnel on the rack. Each truck has capacity for holding thirty-six trays, each 6 feet by 3 feet in area, making a total capacity of 396 trays to each tunnel when fully loaded, with a total spreading area of 7,128 square feet.

The system of air supply is under perfect control. The whole output of the fans under ordinary conditions of evaporating or dehydrating is passed under the body of the furnace through a concrete basement, and then into the interior of the furnaces through two horizontal valves, hinged to and forming portion of the bottom of furnaces, each 7 feet 10 inches by 3 feet in area. These valves are under independent control, and can be used either conjointly or separately, and can also be fixed in such positions as to allow the whole of the air or any portion of it to pass up into the furnaces; the balance of the air not passed into the furnaces being by-passed under them, and mixing with the heated air at the central breeching-piece.

The central control valve operates at this point, and is fixed in a vertical position with a vertical shaft, and a tiller handle can be disposed at any angle so as to pass any quantity of air into either tunnel, right or left, through the transverse air duct. This enables either tunnel to be operated independently or the two to be operated simultaneously.

There are also provided two cold air ducts, which(formed in concrete underground) lead the air from either fan quite clear of the furnace, and open into the transverse air duct between the central valve and either tunnel entrance. Each cold air duct is controlled by a wrought-iron valve, which can be fixed in any position so as to allow the whole of the air output of each fan being passed into the cold air ducts or diverted under the furnaces.

The construction of the plant is very substantial throughout. The fans, both casing and multivane wheel, are of heavy wrought-iron sheets and angle iron.

The furnaces are built with heavy cast-iron fire-box sections with 4-inch fins on the exterior surfaces, and with heavy cast-iron fronts and backs, and double baffled cast-iron firing doors.

The flue gases pass out of both fire-boxes into rear combustion chambers, and then through nests of 4-inch boiler tubes into front combustion chambers, and from there through other nests of boiler tubes into rear combustion chambers, and then into separate flue stacks from each furnace. It will thus be seen that the air while being heated is entirely separate from the products of combustion, which are inside the tubes and fire-boxes, so that the whole of the air passing into the tunnels is perfectly free from any contamination.

The transverse air duct, breeching-piece, and both tunnels are entirely formed of wrought-iron angles and tees, with heavy gauge galvanised sheet-iron walls and roofs. Each tunnel is provided at each end with vertical sliding doors, fitted in wrought-iron frames, and being fitted with counter-poised weights and pulleys they open to the full height and width of the tunnels, enabling the trucks loaded with fruit trays to pass unimpeded into the tunnels. The fruit trucks can be passed through either door and in either direction.

The Experiments and the Results

The experiments were commenced early in December, 1921, and were continued at intervals over a month as materials came to hand and opportunity permitted. The fruit used consisted of last season's dried nectarines, prunes, currants, and sultanas, in each case heavily infested with Indian meal moth (*Plodia interpunctella*) in all stages of development.

In the early experiments the fruit was treated at a high temperature (up to 200 degrees Fah.), but experience soon proved that these temperatures could be reduced by more than 25 per cent. without loss of efficiency.

The procedure in each experiment was as follows:—The dehydrator was brought to and held at the temperature required for the experiment, and the fruit—infested with eggs, larvæ, &c., of the Indian meal moth—was spread on wooden trays so as to allow free circulation of the air, and then placed in the tunnel of the dehydrator, where it was exposed to various temperatures for varying durations of time. The fruit on removal from the steriliser was immediately examined microscopically, and a control sample taken for preservation and future examination.

The size of the tunnels enabled the observer to enter them during the course of the test, so that the fruit could be examined at any stage and notes be readily made. The trays used were of wood with solid bottoms, but a slat-tray would be preferable as allowing better circulation of air. A wire-mesh tray gives good results, but is objectionable for use with fruit that has been sulphured on account of the deposition of zinc sulphide on the wires of the tray.

The experiments were in almost every case extremely satisfactory. The most efficient temperature proved to be 145 degrees to 146 degrees Fah. for ten to fifteen minutes.

The eggs of the moth were satisfactorily treated by this method, being dried and shrunken and vitality completely destroyed. Freshly deposited eggs required a slightly longer time in the steriliser than those some hours older. Larvæ when exposed were killed within a few minutes, but where protected by the fruit required longer, though where larvæ were buried in the flesh of a prune, against the pit, or where several prunes were stuck together, all larvæ were destroyed after ten minutes at a temperature of 145 degrees Fah. In the case of pupæ it was equally effective. The adult moth offers very little resistance to heat, dying in a few seconds.

The advantages of being able to use such low temperatures as those mentioned above and yet effectively to destroy insect life are obvious. There is no risk of damaging the fruit, as the temperature is no greater than, and even below, that at which the fruit is dehydrated. In so far as the destruction of insect life is concerned, there is nothing to recommend higher temperatures than about 146 degrees Fah., the tests at that temperature being quite as effective as those at a higher one, and obviating any danger of damage to the fruit from overheating. In using these low temperatures a high air velocity is essential, the hot, dry blast being extremely deadly to insect life. Larvæ protected by the high sides of a box from direct contact with the current of hot air resisted temperatures of 160 degrees Fah. and over; it is therefore necessary to spread the fruit as thinly as possible on the trays in order to ensure thorough penetration by the air.

Full details of two typical tests may prove of interest and are set out hereunder. It is not possible, however, to give any figures as to the humidity of the air during the experiments as the recording instrument was unfortunately broken at an early stage in the experimental work. With the temperatures used and high air velocities secured, the humidity of the air in the tunnels would be very low, the air moistened by passage over the fruit being carried away rapidly:—

Details.	Experiment A.	Experiment B
Date	17th Dec., 1921.	19th Dec., 1921.
Fruit	Prunes and sultanas.	Sultanas and currants.
Engine velocity (revolutions per min.)	108	72
Fan ,, ,,	225	170
Air ,,	1,000 L.F.M.	700 L.F.M.
Temperature of entering air at fan	96 degrees Fah.	94 degrees Fah.
,, outside air	95 degrees Fah.	96 degrees Fah.
Maximum temperature on fruit	144 degrees Fah.	147 degrees Fah.
Average ,, ,,	142 degrees Fah.	145 degrees Fah.
Fruit placed in steriliser	4·56 p.m.	10·20 p.m.
Fruit removed from steriliser	5·11 p.m.	10·30 p.m.
Duration of experiment	15 minutes.	10 minutes.

Experiment A.—Fruit infested with eggs and larvæ of *Plodia interpunctella*. All exposed larvæ were dead within first three minutes. At the termination of the test all insects were found to be dead, and the larvæ were discoloured and flaccid, while the eggs were dried and shrunken.

Experiment B.—Fruit infested with eggs, larvæ, and pupæ of *Plodia interpunctella*. Found to be satisfactorily destroyed at the end of the test.

The control samples taken after each lot of fruit had been passed through the steriliser were carefully labelled and placed in insect-proof receptacles and microscopically examined from time to time. They have been under observation up to the present time—a period of over four months—and have shown no trace of any further development of moth, and have remained in the same sterile condition as when removed from the steriliser.

With a plant such as that employed for these tests there is no doubt that the sterilisation of dried fruits can be effected on a large and commercial scale. Fruit coming in from the drying greens or from outlying sheds can be treated before being packed, and where stocks of fruits have been held over in the packing sheds it can be run through the steriliser in a comparatively short time prior to being cased.

The packing shed should be insulated with wire fly gauze, and kept in a thorough state of cleanliness, all waste fruit being destroyed, and as little as possible harbour left to shelter the moth. The floor of the shed should preferably be of concrete, and where the floors are of wood precautions should be taken to prevent waste fruit, &c., from accumulating beneath them to form a breeding ground for moth and other pests of dried fruit.

Moth larvæ have been found in "split pits" of peaches stacked near the packing sheds and drying grounds. Specimens were bred out for identification, and proved in all cases to be the Indian meal moth (*Plodia interpunctella*). These waste pits are therefore a prolific breeding ground for the moth, and every care must be taken to see that all pits are utilised as fuel for the boilers, or completely destroyed in some other suitable manner.

The past season has been a bad one for moth, fruit being heavily infected, and adult moths having been plentiful even in places remote from stores of dried fruit.

Further experiments in the control of dried fruit pests is of the greatest importance, and further work in this direction will be carried out as opportunity permits. Sufficient information has, however, been obtained during the season's work to provide a definite basis for future experiment, and it is reasonably to be expected that by the use of a plant similar to the one described above, and the exercise of care in seeing that the fruit is not exposed to re-infection in the packing shed, dried fruits may be despatched from the warehouses free from moth. Fruit well packed in close-fitting cases and with a large turnover in the lining paper will remain clean for a considerable period, even when otherwise exposed to the possibility of infection.

A USEFUL SCALE-EATING MOTH.

CITRUS growers will sometimes notice on trees affected with red or other scale certain lumps that at first sight might themselves be taken for very large scale insects. Actually, these lumps are the cocoons of the useful scale-eating moth, *Thalpochares coccophaga.* This moth lays her eggs among the scales on the infested trees. From these eggs tiny caterpillars emerge, to feed upon the scale and at the same time construct over their backs a silken covering, under which they can crawl about and attack their food quite freely, although protected from above. When the caterpillars are full-grown they attach their protective coat to the twigs, seal it on the under side, and convert it into a regular cocoon. The caterpillars are found all over badly infested trees, sometimes completing their cocoons right on the ground line. Obviously these lumps on scale-infested trees should be regarded with favour by orchardists and not destroyed.—T. MCCARTHY, Assistant Entomologist.

Dairy Produce Factories.

THEIR CONSTRUCTION, EQUIPMENT, AND OPERATION.

L. T. MACINNES, Dairy Expert, Department of Agriculture.*

THE State Dairy Industry Act provides for the registration of dairy produce premises under conditions laid down, the inspectors appointed under the Act having specified powers which no regulation can add to or take from. These powers carry with them the danger of varying action being taken in different districts, and it is necessary that there should be uniformity of procedure in the interests of all concerned.

In connection with this the Department wishes to compile a guide for the information of both inspectors and manufacturers, covering the construction and equipment of dairy produce premises.

Definition of a Dairy Produce Factory.

Under the Act the factory that makes 100 tons of butter a week, and the small dairy that makes and sells 3 lb. of butter weekly, are both classified as "dairy produce factories" This is just to neither. It would be impossible for the individual operating in a small way to erect and equip premises on the same scale as a large factory. On the other hand, it is detrimental to the reputation of New South Wales if butter and cheese made at these poorly equipped and operated dairies should be marketed under a similar trade description to that used by the large manufacturer. It is proposed that each class should be registered under a distinct name and comply with separate conditions, the one being called a "dairy produce factory," and the other by some other name. For the purposes of the present discussion, it is proposed to confine our attention to a "dairy produce factory."

Quality.

The reason for controlling the construction, equipment, and operations of dairy produce factories may be considered as, (*a*) to safeguard public health and ensure a pure food supply; (*b*) to improve the quality of the output. The first does not concern this paper; the second, quality, is the supreme thing in the world to-day. Inferior goods are hard to quit; for the choice grade there is always a buyer. Good reputation should be the shadow of consistent good quality, and is a prize worth gaining and retaining—it can be cashed at face value.

In the world's markets Danish butter has the premier reputation and brings the highest prices. New Zealand has also earned a good name and gets within 12s. per cwt. of Danish; Australia's output has been labelled to bring 8s. per cwt. less than the New Zealand brands. New South Wales, on the amount exported last season, lost thousands of pounds a week through not getting the same price as New Zealand on the English market. In America, New South Wales choicest grade has earned a reputation for good consistent quality, second to none. It is bracketed with the best that New Zealand can market there—some even give the preference to our brands. On the American market New South Wales choicest brought at least the same price as New Zealand choicest. It should do so in England, yet cables dated 17th of the month of June, quote New Zealand second at 192s. to 194s., and Australian choicest at 192s. to 196s. It is just as necessary for the seller and the buyer to base their operations on quality as for the producer and manufacturer.

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*Paper read at the New South Wales Factory Managers and Secretaries' Conference, Sydney, June, 1922.

Good quality and name cannot be dissociated from the other component parts of the dairying industry. They are the reason for having factories constructed, equipped, and operated by the highest standards. If we make the choice goods, we must also have the reputation and grade value for same. The extra money thus obtained would pay for the building and re-equipping of our factories.

New South Wales sent a record quantity of butter to England last season, and over 60 per cent., say 9,000 tons, it is understood, was of choicest grade. That butter on its quality should have brought within a few shillings per hundredweight of the "Lur" brand. It is with the balance, however, that this paper is primarily concerned; a secondary consideration is the danger of slipping back to below the 60 per cent. level for choicest export.

The quality of our butter must be not only maintained, but improved. The 40 per cent. of lower grades should be changed, until we have at least 90 per cent. of our exports grading into the highest classification.

What Makes for Quality.

Quality in butter depends on—

(*a*) The raw material.

(*b*) Factory water supply, premises and surroundings.

(*c*) Factory plant.

(*d*) Factory operation.

(*e*) Subsequent transit and storage conditions.

The first item, (*a*) raw material, need not now be discussed. The second is important—it embraces the general location and construction of a factory and its water supply. The latter should be pure and of ample quantity. Natural disadvantages should be improved by filtering or other means. The situation of a factory should be decided upon in connection with facilities or general drainage, sanitation, general access, and surroundings. Practically all factories have installed pasteurising plants to destroy, as far as possible, injurious micro-organisms. These installations and their operations involve a large expenditure of labour, time, and money. Therefore, reinfection of the raw material, or of the subsequent manufactured article, should be guarded against. This is of prime importance.

Instances of Reinfection.

1. At an up-to-date factory situated on a dusty roadside, which is subject to large motor traffic, the cream was pasteurised by the flash system, and cooled over exposed pipes. At the time of inspection the general conditions were favourable, rain fell overnight, and laid the dust on the road. There was no wind.

A plate exposed for five minutes alongside the cream pipe-cooler showed very large infection—largely of the coliform group of organisms—coming from manure pulverised into dust on the road. This type of organism is responsible for unclean flavour in butter.

The cream was effectively pasteurised, but when churned was found to be recontaminated.

A shire or municipal council could, in conjunction with the dairy company, speedily remedy this state of affairs, by taking simple and comparatively inexpensive means to lay the dust nuisance causing the trouble.

2. A well constructed brick factory situated on the tablelands, produced choicest cream effectively pasteurised by the holding system, but the resulting butter regularly deteriorated to second grade. Plates exposed to the atmosphere inside the factory showed the premises were clean. Plates made of pasteurised cream were clean; those made of the butter showed the presence in enormous quantities (over 150 millions) of injurious organisms of the proteus and coli groups. Investigations showed the well water to be infected with these organisms, and further investigations led to the discovery of the cause. Remedial measures were taken which have been effective. Butter made from this factory's best cream can now be marketed after months of storage as choicest grade. The bacterial counts were:—Cream after pasteurising, 500 per c.c.; butter when marketed, 750,000 per c.c.

3. In a new factory situated on a river bank, mould was discovered on butter box boards in the box-making room. Air exposure plates in the manufacturing and cold storage rooms discovered mould spores in large quantities. Remedial measures were at once taken, preventing a factory costing over £10,000 from becoming mould-infected within a few weeks of completion.

4. An old, badly planned, ill-kept factory, situated on the edge of an unclean stagnant lagoon and dusty unclean surroundings gave a bacterial count of pasteurised cream showing reinfection running to over 180,000,000 per c.c. Plates exposed to the atmosphere in every room used in the manufacture and storage also showed infection from mould and putrefactive organisms. These premises and site were condemned.

5. An old condemned factory was being used, pending removal into new premises. The cream was pasteurised; butter packed and held several weeks

in the factory cold room opened up in a mouldy condition. The previous inspection of the factory disclosed that it was heavily infected with injurious micro-organisms including moulds. The bacterial counts were:—Cream after pasteurising, 24,700 per c.c.; cream after holding in open vats for twenty hours, 1,291,500 per c.c.; butter when packed, 2,244,000 per c.c.

These examples are given to demonstrate the need for properly constructed and well-kept factories, without which quality is injured, and reputation and money are lost. The interests of the State and of the producers engaged in dairying demand that factory directors and managers take a serious view of their obligations in this respect. Where cream is kept after pasteurising in sealed vessels it is to an extent guarded against adverse outside influences; where it has to be exposed to the air, the whole of the surroundings should be kept clean and all available sources of contamination cut off or controlled.

The question affects the whole of Australia, because the reputation of the whole industry is adversely affected by the retrogressive attitude or condition of the worst factory operating in the Commonwealth.

Materials for Constructing Dairy Produce Factories.

Dairy produce factories should be constructed with one or a combination of the following materials placed in order of preference:—

1. Reinforced concrete throughout all basements, floors, and walls.
2. Reinforced concrete base, brick superstructure.
3. Brick walls throughout—for 6 feet from floors in manufacturing rooms faced with cement.
4. Concrete or brick base, wooden superstructure—walls impervious for 6 feet from manufacturing floors.
5. Wood walls throughout, or wood and fibro-cement—impervious for 6 feet in manufacturing rooms.

The essentials to be studied and provided for are sanitation, light, ventilation, and general plan for economical and efficient working and durability.

Sanitation must embrace a good system of drainage for the disposal of waste milk and water, and precautions against infecting the interior and surroundings of the premises.

Sunlight is the best germicide known. Light is also necessary to enable operators to carry out their duties properly. Therefore, the making of provision for proper lighting is most important, expecially in the cream storage, manufacturing, and testing rooms. There should be no dark corners or recesses as these encourage and harbour organisms which may be circulated throughout the factory by air currents. Light should be fully admitted from overhead, as well as by side windows. That from overhead should be diffused, so that the perishable products underneath may not be injured by the direct rays of the summer sun.

Plenty of *ventilation* is required; the walls and roofs should be high, the ceiling following the contour of the roof. All overhead obstructions, such as beams, pipes, belts, and flat ceilings should be done away with. Overhead ventilation by cowls through the apex of the roof should be provided, in addition to provision for air currents to go from end to end or side to side of the premises. By having the ceiling follow the contour of the roof the air space is greatly increased, and lodgment for dust eliminated to great extent. It also allows steam to get away freely, and thus minimises danger from mould infection.

The *general plan* should obviate excess handling of the products and materials used. Labour-saving should never be lost sight of. One New South Wales company on transferring to its new premises found it could handle an increased supply of over 25 per cent. with three hands less, and at the same time turn out a uniform 93-point butter in place of an 88-point article. Thought should be given to saving cartage and freight handling. These all mean a reduction in the cost of manufacture, and at the same time tend to improve the quality of the manufactured product, that is, ensuring a higher selling price.

Old decayed buildings and timber should not be allowed to remain near a well-kept factory, neither should such premises be adjacent nor used as habitations.

The Equipment of a Dairy Produce Factory.

The equipment of a dairy produce factory should be installed to effect—

1. The manufacture and marketing of the highest grade product.
2. The efficient, quick, and economical handling of produce.

Under the word equipment is included cold and general storage facilities. Ample provision should be made for the supply of steam, driving, and refrigerating power; large reserves of brine, cold and hot water, chilling store rooms to hold butter at sufficiently low temperatures, cheese-curing rooms in which temperatures can be controlled. The necessity for sending butter over long distances in the hot weather in hard condition must be remembered. The holding vats and manufacturing plant should suffice to handle easily the maximum supplies expected. Duplication of steam refrigerating and motor power is advisable. Plants to pasteurise milk or cream are necessary. All vessels used for containing, or which come in contact with milk or cream should be kept in good order, especially regarding being well tinned. Washing and cleansing appliances should be available, and in this connection a good supply of hot water under pressure should be provided for. Cream fluming should, where possible, be open.

Drains should be open and readily accessible. Brine and cold water tanks should be insulated or preferably placed in an insulated room. These tanks should never be placed over cold rooms.

An outfit that can be recommended to save the company money is one that will paraffine butter boxes.

The Operation of a Dairy Produce Factory.

The State Dairy Industry Act controls the working of a factory to a great extent. Cream has to be graded to quality, and butter made therefrom is correspondingly graded at the factory. The neutralisation of cream should receive most careful attention and be controlled by acidity tests, which should be recorded. Haphazard rule of thumb measures should not be tolerated in the neutralising process. Butter graded and packed at the factory is check-graded by State officials for the purposes of the Dairy Act, and also for giving instructions and advice to the manufacturer. Cream grading is checked by the resident field instructional officer, and on this is based advice given to the farmers.

The carriage of dairy produce is a matter that requires constant supervision, not only from farm to factory, but from factory to market or shipping port.

Conclusion.

This paper has only briefly touched on these big subjects. It is read to invite and promote discussion to bring the views of this Conference before those who will discuss details later on.

During the war and subsequent drought, factory renovations, rebuilding and re-equipping were checked to a certain extent in some quarters. Now it has to be faced. Factory directorates have, unfortunately, in some instances not made proper provision for meeting such expenditure. There is need for an organised plan throughout the State to deal with the situation ; failing that, each company must work out its own problem. Where possible, overlapping factories should merge, and thus cut down the cost of reconstruction and manufacture, which are all met by the farmer.

SUBSTITUTE POLLEN FOODS FOR BEES.

OF rye-meal, pea-meal, and cocoa, the three materials which may be utilised on occasion as substituted pollen foods for bees, the first-mentioned may be regarded as the best and most economical.

Only at times of severe drought, and during an almost absolute dearth of bloom, should it be necessary to feed such substitute foods. If the bees show signs of pollen shortage by raiding pollard or flour bins, or if a serious lack of natural pollen is suspected, then rye-meal may be given, but it is very unlikely that a serious dearth of natural pollen will occur during the coming spring.

Rye-meal can usually be purchased from any of the large city stores. If the rye is milled at home, the mesh of the sieve need not be too small, as the admixture of small particles with the flour will assist the bees to get a footing while gathering it. A fair percentage of flour should, nevertheless, be present.—W. A. GOODACRE, Senior Apiary Inspector.

Staggers or Shivers in Live Stock.

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"STAGGERS," or "shivers," is the local term applied to an enzoötic and apparently non-contagious affection of horses, cattle, and sheep, occurring in certain parts of New South Wales, viz., the alluvial areas of the basin of the Namoi River, together with some of its tributaries, and on the Gwydir River. It has not yet been established that the disease affecting all three classes of animals is identical, but circumstantial evidence strongly indicates that it is. The present article, except incidentally, deals only with the condition as it occurs in sheep, and details investigations carried out up to the time of writing.

History.

The condition has probably been in existence some considerable time relative to the settlement of the affected areas, but the first official reference to it is a report by E. Stanley, F.R.C.V.S., published in the New South Wales *Agricultural Gazette* for 1895, on a disease known as "Shivers, *i.e.*, Tremors in horses, sheep, and cattle." Stanley commences his report as follows:—"For many years a disease has existed amongst horses grazing on certain low-lying, marshy lands, which is usually known as shivers."

In 1900, J. D. Stewart, M.R.C.V.S., published in the same *Gazette* a progress report on investigations carried out on staggers in sheep at Narrabri (in the Namoi basin), and in 1911 Henry and Massy, writing in the same journal on "Some neglected sheep diseases in New South Wales," refer to an enzoötic disease of staggers in sheep, goats, and cattle in New England. The evidence available, however, always pointed to the last-mentioned affection not being identical with that of the Namoi basin, and the experimental work detailed herein confirms that opinion.

Country in which the Condition occurs.

Geographically, staggers appears to have a fairly definite limited area, viz., the basin of the Namoi river and its tributaries, and the Gwydir and Peel rivers; and here it is apparently confined to the alluvial flats which extend for a varying distance from the rivers. In some instances the area is very narrow, but in others it extends laterally some miles. It is nearly all what is known as "black soil country," and almost all of it is subject to periodic floods from the main rivers mentioned or their tributaries. Almost the whole of it is herbage country, interspersed at irregular intervals with patches of grass country. Herbage country is a term applied to land on

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which there is, as a rule, very little grass, but on which, after rains, especially winter rains, there is a luxuriant growth of both native and introduced plants, such as various species of crowfoot (*Erodinum* sp.), trefoil (*Medicago* sp.), thistle (*Carduus marianus*), and mallow (*Malva parviflora*).

There is no evidence at present of the disease occurring naturally in any other part of the State.

Animals affected.

Although with cattle the evidence is not so definite, it is quite probable that they do become naturally affected. It is, however, in sheep that the most numerous cases are seen. One must take into consideration that by far the most numerous of the live stock population in the areas mentioned are sheep, consequently one would expect to find the incidence of the disease greater in them. Neither sex, age, nor condition appear to have any influence on its occurrence, but young animals are said to suffer most severely, even suckling lambs and foals being affected. Experimentally, it will be seen that in suckling lambs the disease made its appearance much quicker than in adults. Fat animals appear to suffer most as concerns adults, but this is probably because they are heavy feeders and have most weight to carry. Furthermore, on affected country where sheep are fat, it means that the supply of mallow and *Lamium amplexicaule* is abundant, and these two certainly constitute a nourishing fodder. The occurrence of the disease in very young lambs from a few days old suggests that the causal agent may be transmitted in the mother's milk.

Period of the year when Staggers is prevalent.

The disease is much more prevalent in some years than in others, being influenced by the character of the season. As a rule, it is more evident during or following a good rainfall, when there is a luxuriant growth of herbage in spring, following a mild winter. It has, however, been seen in a dry season when only dried herbage was available as fodder.

Some Records of the occurrence of Staggers in sheep.

1. Three thousand sheep were being driven to the trucking yards. *En route* they showed signs of staggers, and in a few hours 1,200 were incapacitated. The animals were left at rest in a neighbouring grass paddock for five days and then travelled several miles to the yards without any further indication of illness.

2. A number of sheep were brought in from a distant station quite sound. They were placed in a paddock in which staggers was known to occur. A fortnight later, on an attempt to transfer them to the trucking yards, it was found that so many of them were affected that it was impossible to do so.

3. Two thousand ewes with lambs, sound when started, were travelled from Inverell to Moree, a distance of about 80 miles. They were rested for one day only on a stock reserve. When the journey was continued, and before they had travelled a quarter of a mile, 600 showed evidence of staggers and thirty died. Even lambs two or three days old were affected.

4. The following is one of the best authenticated histories of a natural outbreak. On 28th August, 1920, a small flock of 150 ewes with lambs (Everson, owner) were moved from a farm to a small paddock, a distance of about 9 miles. These ewes had been running in a wheat paddock, where they had lambed, and had remained there until they were removed to the place mentioned. The locality from whence they were taken is hilly, red soil, with pastures of trefoil, crowfoot, and grasses. It is not the type of country usually associated with staggers, and there is no record of any animals on the farm ever being affected with that disease. No mallow was found on the farm when inspected shortly after the events to be related. All the animals travelled the distance in two days with ease, no illness occurring. The paddock in which they were placed on completion of their journey is a small alluvial one on the banks of the Peel river, and in this the ewes and lambs remained for four days, cropping it very closely. The pasture consisted of trefoil, crowfoot, mallow, and a little grass and other herbage. At the end of four days, the animals were removed to another small paddock about 5 miles distant. Almost immediately after starting on their journey staggers in a severe form made its appearance in the lambs, and only after considerable difficulty, many being carried, were they and the ewes got to their destination. This paddock was very bare and consequently, three days later, they were again removed to another paddock about half a mile away. Great difficulty was experienced in getting the animals to travel the distance, about 50 per cent. being more or less seriously affected, many of the lambs having to be carried. None of the adult sheep were affected. The last-mentioned farm is a red soil one, the feed being lucerne, trefoil, and other herbage, but no mallow. The roads leading to it were very bare. No staggers has been known to occur here. Four days following the last move, the flock was driven about three-quarters of a mile without any sign of the disease in question being observed, except that two or three lambs moved with a slight arching of the back. They were again driven next day without any abnormality being evinced. When removed from the original holding, the ewes were in poor condition, but improved later. The lambs at the start of the move were from a few days to a month old. Others were born during the period under discussion. These sheep were subsequently removed to other red soil areas and kept under strict observation. No further indications of staggers were observed, except in the case of some animals that were taken back to the locality where the disease made its appearance. Here they were kept for experimental purposes and specially fed. These latter sheep are referred to as sheep "E" in experiments described later.

5. In another authenticated case, in October, 1920, 1,200 adult sheep were travelling from Piallamore to Gunnible, a distance of about 58 miles without untoward incident. They were kept at the latter place from seven to eight weeks, and then taken back to Piallamore. On the return journey they took two days to travel 2 miles owing to the occurrence of staggers.

They were then trucked by rail. One died on the road, three in the trucks and three after untrucking. They were untrucked at Tamworth, and with much difficulty travelled 2 miles. The next day there was a slight improvement and they travelled 3 miles. On the following three days, still improving, they did 4 miles each day. A few days later they were mustered for shearing without any trouble, and when off shears, travelled 8 miles on the road without trouble. No subsequent sign of staggers was seen.

Piallamore is steep, hilly country. Gunnible is flat, alluvial, river country with much mallow, but the latter was dying off at the time of this occurrence.

Symptoms.

As a rule no symptoms are seen so long as the animals are grazing quietly in their paddocks, but, in the case of sheep, if an affected mob is started on the road, they may travel a few hundred yards, or a few miles (according to the severity of the case), and then affected animals will begin to lag behind. These move with a rather stiff action of the hind legs, an arched back, and a stretched out head. They travel thus for a little distance, rapidly becoming worse and then stop. Respiration is rapid, but shallow and pulse quick. If urged, the affected animals will travel a few yards and again stop. Sooner or later a quivering or trembling of the muscles of various parts, most commonly of the shoulders and hindquarters, but at times extending over the whole body, ears and legs, will become apparent. At last the animals drop with head and legs stretched out, or with the body resting on the sternum with the forelegs doubled under. Many animals whilst down can be approached and handled without their making any effect to escape. If allowed to rest, these sheep will, after a time get up, and wander away of their own free will. If harassed by being compelled to walk, they will die. On handling, there is at times a twitching of the skin, but the muscles are in an extreme state of flaccidity. Temperatures noted have varied from 104 degrees to 106 degrees Fah. The sensory reflexes are weak or absent. If lifted up, the animal makes no attempt to stand, the limbs remaining quite limp. The urine is clear and colourless. It is often passed during decubitus or after the acute seizure has passed. No signs of pain have been observed.

In the horse, the symptoms are much the same as in sheep. The attack occurs whilst the animal is at work. Perspiration is profuse and respiration hurried. There is lack of co-ordination, and consequently a staggering gait. Quivering of the muscles of various parts is a pronounced feature. If rested a few days, recovery may apparently be complete, but relapses are very common, if the animal's diet remains the same as before.

Post-mortem appearances.

The general condition of the animal is very variable. Often it is very fat. There are no naked-eye changes in the skin, subcutaneous tissues, or organs, except that the liver may be pale and friable, and show fatty infiltration. This may, however, be due to the general condition of the animal rather than to lesions of staggers. Ecchymoses may at times be found on the walls of the auricles, but probably, these are agonal in origin. There may be a slight excess of peritoneal fluid, and at times a considerable amount of fluid in the pericardium. There are no gross lesions of the brain of spinal cord. The cerebro-spinal fluid is clear and colourless.

No pronounced lesions have been observed anywhere.

Attempts to transmit the disease either by inoculation or by contact have failed. In the former, various materials were employed, including blood exudates, cerebro-spinal fluid, and expressed liver juice.

Experiment No. 1.—*Grazing experiment to ascertain whether Staggers can be produced by feeding on natural growing herbage in a river paddock.*

The natural occurrence of staggers in sheep (described in the record of the Everson flock on page 655), appeared so definitely to indicate that the etiological factor of the condition was present in a particular paddock, that experiments to elucidate the matter were determined on. This paddock was accordingly rented, and the fences made secure. The portion of actual flat land was fenced off from another part which showed a gentle rise towards some hills. Two lots of sheep were placed in the flat portion. One lot, to be referred to as " C," consisting of thirty-eight merino ewes and lambs, the latter varying from two days to five weeks old, came from a hilly paddock about 2½ miles away, where staggers is unknown. The road was bare and consequently the animals could have eaten little or nothing at all on the journey. They were in good condition and no abnormality was observed on the way. In addition two ewes and lambs were brought in by lorry from a stagger-free area and placed in the same paddock. The two lots took up their new abode on 11th August, 1920. Their only food was that growing naturally in the paddock.

On 13th August the animals were driven for about ten minutes, and one lamb rapidly showed signs of exhaustion.

On 14th August (three days from the time they were first placed in the paddock), they were again driven round the paddock, and in about five minutes twenty of them were evincing more or less exhaustion and definite symptoms of staggers.

On 16th August (fifth day) they were driven about half a mile along a road and back again, and then around the paddock for about another half a mile. One lamb showed signs of distress and staggers on going out of the gate. Another travelled about 30 yards, and then developed the condition. Two more about 40 yards further, and then at varying intervals along the route, others dropped out. In all, twenty-nine out of a total of forty-nine lambs developed symptoms of distress and shivering that would warrant one deciding that they were clinically affected with staggers, whilst others were evidently not normal, although their condition was not sufficiently pronounced to warrant one deciding that they were affected beyond doubt.

None of the ewes showed any signs of distress.

It was observed that the lambs had lost conditiom while in the paddock. The majority of the lambs were about three weeks old. There was nothing in the drive that should have caused normal lambs any distress, even if in poor condition. The symptoms shown were evident weariness and distress, stilty action in walking, back arched, tail carried out, some contraction of the abdominal muscles. The hind legs were brought well under the body in moving, the gait resembling that of a horse affected with laminitis. In numerous instances the lamb when stopped, was seized with a violent fit of trembling, the ears, legs, and trunk being affected. After a few minutes' rest this subsided, and the animal could travel a short distance, but if hurried it was liable to be seized with fresh spasms. Later on the animal would lie down, either propped up on its sternum with legs doubled under and head stretched out, or more rarely it would lie stretched out on its side. In a number of cases this collapse occurred without any previous trembling.

When down the animal could be handled without any attempt at resistance. On manipulation there was at times a twitching of the skin, but the muscles were in an extreme state of flaccidity. There was no rigor or tetanic spasm. The legs could be lifted without resistance, and if released would drop laxly. The heart's action was tumultuous, pulse rapid and uncountable, respirations rapid and at times jerky. The rectal temperature in one case was 104 degrees Fah., in another 106 degrees Fah. At no stage was any animal unconscious. Urination sometimes occurred during decubitus.

At the completion of the drive, many of the lambs lay about in a state of exhaustion, but eventually all got on their legs. Six hours later, some still showed the characteristic gait and trembled after moving a few yards. Both lots of lambs were affected and to an equal extent. None of the animals had any water between the time they were placed in the experimental paddock and the drive, as it was not required, on account of the herbage being so moist. The day of the drive was cool and cloudy.

On 17th August (sixth day), thirty-one of the " C " lot of ewes were removed from the paddock to a farm 2½ miles away, as the former was being eaten out. They were travelled on foot at a moderate pace, but the majority of the lambs became affected to some extent and twelve collapsed. Some recovered after a rest, but soon had a relapse after travelling a short distance. The distress of all lambs was very pronounced. These were the same lambs that on 11th August had travelled the same road and distance at a fast pace without the slightest sign of distress.

As a control, six ewes and lambs of the same age and type were brought from the paddock whence these " C " sheep originally came, and were travelled by road to the experimental paddock at a fast rate. None showed the slightest abnormality.

The result of the foregoing experiment, together with the previous history of the place, indicated pretty conclusively that the causal factor of staggers existed in the experimental paddock, and, in view of the general opinion of stockmen that mallow was the cause of the trouble, it was decided, in spite of previous failures (*vide* "Attempts to transmit by feeding"), to persevere with feeding experiments with this plant in an affected locality.

Later on it was decided to confirm the foregoing experiment with sheep brought from some distance, and accordingly, on 25th September, 1920, six such ewes with lambs were placed in the experimental paddock. They were subsequently tested on two occasions by driving (3rd and 10th September respectively), but with negative results. It should be noted, however, that during the time these latter animals were in the paddock there was a luxuriant growth of trefoil, crowfoot, and other plants, in addition to mallow, and there was no necessity for the animals to eat the latter, which, in fact, appeared to be untouched—very marked contrast to the former experiment, when mallow formed the greater portion of the feed, and was well eaten down.

(*To be continued.*)

A QUEEN BEE COMPETITION.

ACTING in co-operation with the New South Wales Apiarists' Association, the Department of Agriculture proposes to hold a queen bee competition at the Government Apiary at Wauchope commencing on 1st November next.

So far as bee-keeping is concerned, this is probably the first venture of its kind ever attempted, but breeding in bees is just as important to the bee-keeper as breeding in stock is to the farmer, and by demonstrating this fact the competition should have the valuable effect of stimulating apiarists to improve the standard of their stocks. Breeding is a matter to which apiarists in New South Wales must ultimately give increased attention, for it is a branch of apiculture with important economic aspects. In different countries are found races of bees of distinctly different characteristics and colour, and by the discriminate crossing of such different races it is possible to obtain strains of exceptional value.

The Italian race has been decided upon in the case of the present competition, which offers any apiarist who considers that he has a good strain of Italian bees an opportunity of having his queens tested out in comparison with others. The competing queens will be introduced into four-frame nuclei colonies as nearly as possible equal in regard to number of bees and quantity of honey, the colonies being made up to even strength after the expiration of six weeks, and a two-season test in relation to comb-building, building-up, non-swarming, disease-resisting, and honey-gathering quality, stamina, and capacity to winter will then commence.

Regulations have been drawn up, and anybody interested can obtain a copy by application to the Under Secretary and Director, Department of Agriculture, Sydney.—W. A. GOODACRE, Senior Apiary Inspector.

A NOTE ON MOUSE PLAGUES.

THE extraordinary and rapid increase in a species until its numbers assume the proportion of a plague is rare among mammals, but such increases—as New South Wales farmers know to their cost—are frequent in certain countries among several species of field mice which, owing to their great fecundity, are liable to break out periodically in vast numbers. Mouse plagues were always regarded with wonder and superstition in early times, and they are still looked upon in some countries as something bordering on the miraculous. What, then, actually are the influences that periodically culminate in a mouse plague?

Qualified observers agree that although the final production of mice in plague numbers is comparatively sudden and takes but a few months, increase has taken place for a season or two before. Thus, in cultivated lands, where food is abnormally plentiful and the presence of natural enemies limited, the animals may begin to increase greatly for even three or four seasons preceding the outbreak, the rate of multiplication gradually becoming more rapid until eventually the pest is present in plague numbers. The plague period proper—from the time of the commencement of the abnormal increase to the time of the maximum stage of the visitation's intensity—therefore often covers three or four years. Apart, however, from the special opportunities for increase offered by abundant food supplies and the absence of natural enemies, observations in other countries indicate that mice periodically tend to enormous multiplication. This would seem to be an inherent tendency.

When the mice have increased excessively they migrate in large bodies, travelling long distances and devastating the vegetation in their path. The mice being gregarious by nature, the vast bodies they form gradually extend from exhausted to fresh areas, until at length extensive districts are overrun. Under normal conditions, mice are always present in or near the districts which they occasionally overrun, but ordinarily they live in small colonies in favourable locations—particularly in damp areas bordering swamps, streams, or ditches.

Once a plague reaches its maximum intensity, natural control invariably asserts itself. The subsidence of a plague usually begins to take place during the winter and spring, disease, predaceous animals and birds eventually getting control; and this subsidence may be followed by long periods of depression, several years elapsing before a plague occurs again. Like the development of a plague, its subsidence is so gradual in its early stages as to be scarcely perceptible, though very apparent later on.

Agricultural development of any country increases the occurrence of plagues by furthering the destruction of the rodents' natural enemies, by furnishing a greater abundance of food, and by increasing the number of areas in which they can find suitable homes. An interesting feature of this subject is that for some inexplicable reason mice in one locality may fail to reproduce, while the same species, apparently under no more favourable conditions, may be extremely prolific.—T. McCARTHY, Assistant Entomologist.

The right time to plant pepper-tree seed is as soon as it is ripe. Planting may be done at any time of the year except midsummer.—E. N. WARD, Superintendent, Sydney Botanic Gardens.

A Kit of Carpenter's Tools.

WITH SPECIAL REFERENCE TO PLANES AND SAWS.

M. H. ROBERTSON, Instructor in Carpentry, Hawkesbury Agricultural College.

FOR a man acquainted with the art of carpentry, or even slightly gifted in that direction, it is not a difficult matter to pick up a saw, hammer, chisel, or plane, and to set about the making of a gate or a wheelbarrow; but when one who knows little if anything about the business finds that his chisel, plane, and saw are blunt, and that things are otherwise "cranky," it is a different problem altogether, and it is then, perhaps, that the truth comes home to him that what he requires is not only the tools, but the knowledge of how to handle them and to put them and keep them in good order.

Elementary as it may appear, it is nevertheless necessary to know both how to hold and how to adjust a tool, and before the beginner can turn out a satisfactory job these things must be mastered. In the hope that the information will be useful to farmers, it is proposed to offer a few pages about the tools that may usefully be found in a farmer's kit.

Sharpening the Planes.

The sharpening of plane irons and chisels is very similar, and if the former is mastered, the latter will not be found difficult. Two angles have to be kept in mind—the grindstone angle, which is the angle at which the iron is held on the grindstone (about 30 degrees) and the oilstone angle, which is the angle at which the iron is held on the oilstone to get a fine cutting edge.

To grind a plane iron or a chisel, rest the handle or end of the iron on the frame of the stone with the iron against the stone (see Fig. 1). Plenty of water must be played on the stone while the stone is turned on to the iron. Care must be taken to keep on the outside edge of the stone, or the stone will be worn hollow, which will make it very hard to grind the irons true—a most important point.

On the oilstone, the angle should be about 36 degrees. The stone should be placed firmly on the bench, lying straight away from the body (Fig. 2). Keep plenty of oil on the stone, and work the iron as near as possible the full length of the stone, keeping the iron square on it, and at the same time moving from side to side, so that the stone shall be worn evenly. A light burr will often form on the edge as the sharpening on the oilstone finishes, and this must be removed by laying the iron upside down on the stone and giving it a few sharp rubs. For this operation the iron must be quite flat on the stone, or another angle may be formed, which will spoil the cutting edge. Even a slight angle when the "burr" is being removed will have the effect of spoiling the edge. The tool must be sharpened in such a way as to have no bevel on the face side.

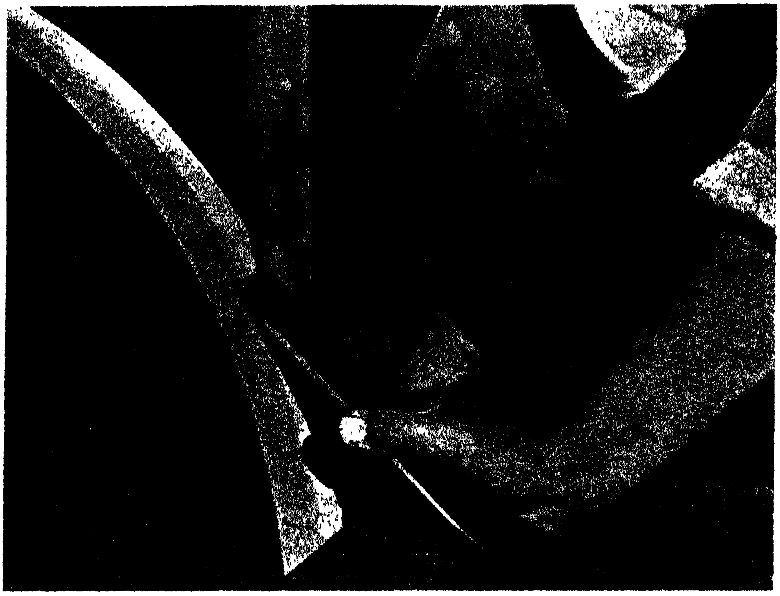

Fig. 1.—Grinding a Plane Iron on the Grindstone.

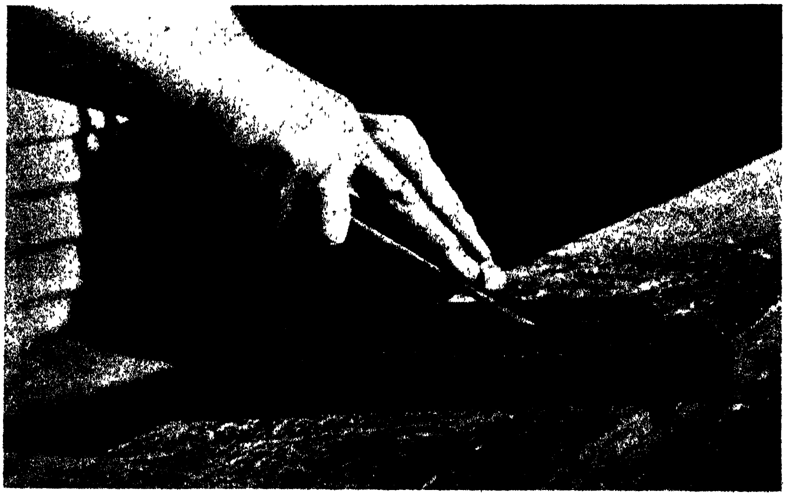

Fig. 2.—Sharpening a Plane Iron on the Oilstone.

The method of Treating a Chisel is the same.

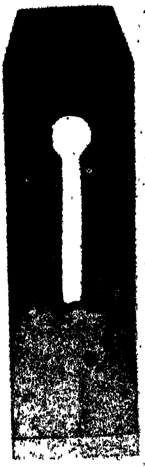

Fig. 3.
German Jack.

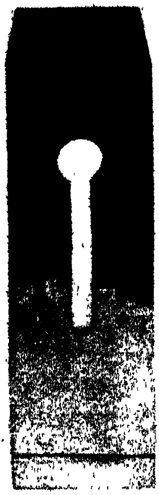

Fig 4.
Jack.

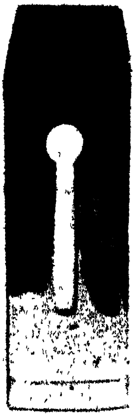

Fig. 5.
Try.

Fig. 6.
Smoother.

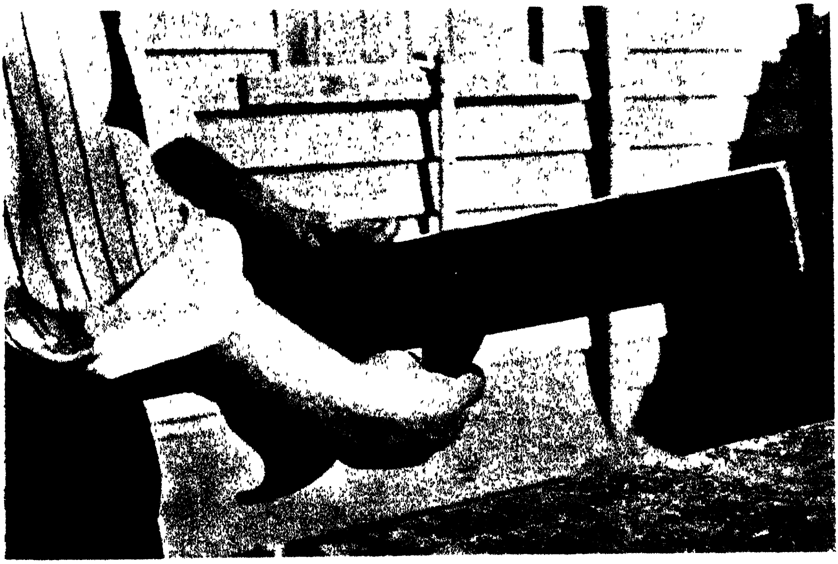

Fig. 7.—Taking the Iron and Wedge out of the Try and Jack Planes.

It is essential that the hands shall not be rocked up and down. The angle of 36 degress must be maintained on every portion of the stone, or a round edge will be made which will not remain sharp, but will soon necessitate more grinding and more sharpening. Nothing is more disheartening to a beginner than continually to be grinding and sharpening. What should be aimed at is a good, clean, square edge.

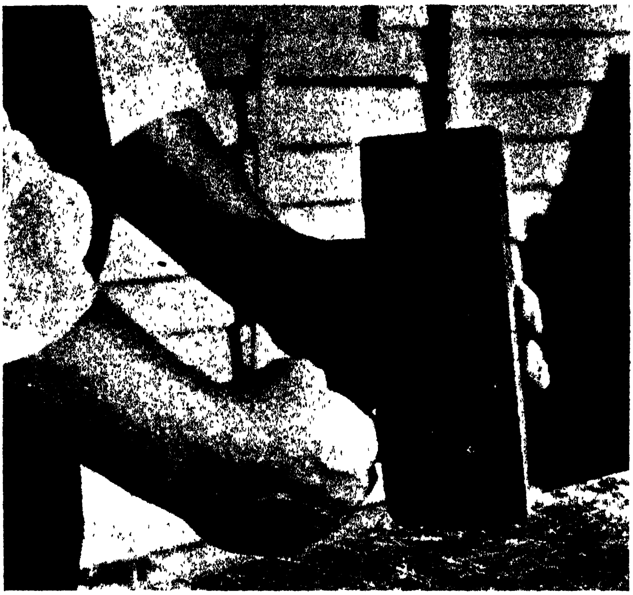

Fig. 2.—Taking the Iron and Wedge out of the Smoother and German Jack Planes.

The Uses of the Different Planes.

Chisels of all sizes are ground and sharpened the same way, but plane irons differ slightly—not in angle, but in shape. They may be briefly described thus :—

Name.	Width of iron.	How edge is ground.	Use of tool
German jack ..	1½ inches	Convex (see Fig. 3)	For very rough work.
Jack	2¼ ,,	Slightly convex (Fig. 4)	For rough work and straightening slightly.
Try	2½ ,, ...	Straight across. Tips of of each corner rounded off on oilstone (Fig. 5)	For making surface perfectly straight.
Smoother ..	2¼ ,, ..	Do (Fig. 6)	For finishing off job smooth.

It is evident that, while all planes must receive careful handling, the two last-mentioned require to be ground and sharpened with special attention, in order that they may do the fine finishing work satisfactorily. But this is not all. The planes themselves require proper care and handling if the best work is to be got out of them. In my opinion and experience, wooden planes are the best to work with, the easiest to keep in order, and the least likely to be broken, and it is with these that I am dealing. A beginner will be well advised to procure second-hand planes (provided they are still in fairly good order), as new tools may be seriously damaged in the process of learning their use.

Wooden planes, old and new, should be regularly oiled all over with raw linseed oil. Great care should be taken of the sole—that is, the bottom—especially of the "try" and "smoother" planes.

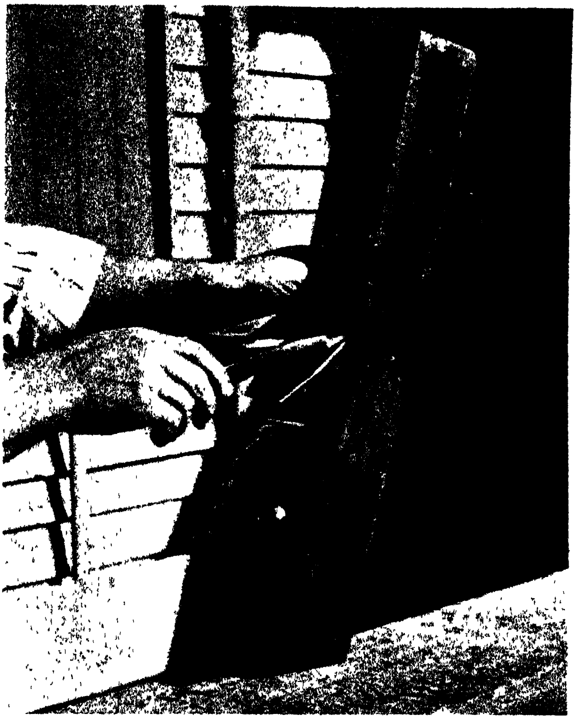

Fig. 9.—Inserting the Iron and Wedge in the Try and Jack Planes.

The smoother, try, and jack planes all have double irons—the cutting iron and the back iron. The cutting iron is, of course, the only one that requires sharpening, and during that operation the back iron should be put aside, but otherwise the two irons are handled as one. The back iron acts as a spring, and keeps the cutting iron rigid. The back iron of the smoother and try should be kept not more than one-sixteenth of an inch from the cutting edge; that of the jack should be not more than one-eighth of an inch from the cutting edge, being brought correspondingly closer for finer work.

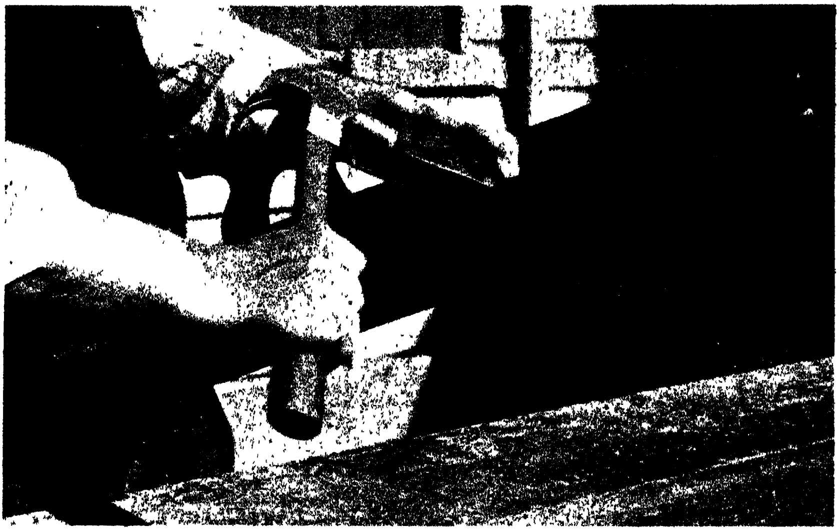

Fig. 10.—Tightening the Wedge and Iron.

The method is the same in the case of all four planes—Smoother, Try, Jack, and German Jack.

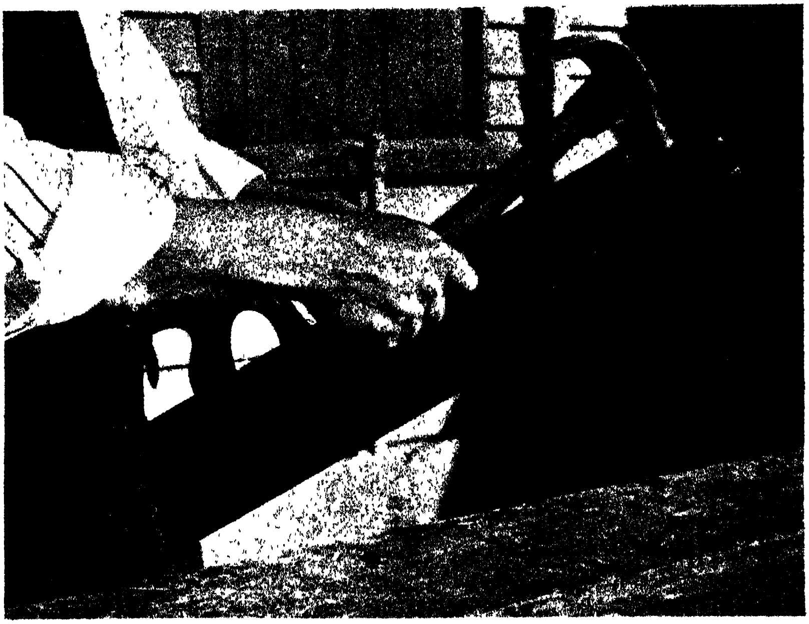

Fig. 11.—Drawing the Iron back a shade.

This method applies to Try and Jack Planes.

Adjusting the Irons.

The planes are not all handled and adjusted the same way. The two largest—the try and the jack—being adjusted in the same way, may be dealt with first.

To withdraw the wedge and iron of the jack, grip the plane in the left hand, and then with the right hand grip the wedge and iron, and strike the front top side of the plane on the solid portion of the bench (see Fig. 7). This will release the wedge and iron.

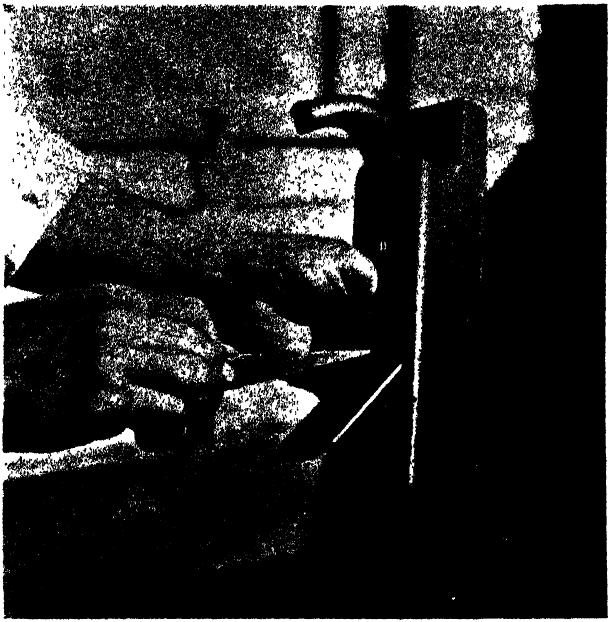

Fig. 12.—Inserting the Iron and Wedge in the German Jack.

Though the extremes in the classes of work they are intended for, the German jack and the smoother are the two smallest planes, and they are handled and adjusted alike. To withdraw the wedge and iron, grip the plane in the left hand, then with the right hand grip the wedge and iron (Fig. 8), and strike the back end of the plane on the solid portion of the bench. This will release the wedge and iron.

The releasing of the wedge and iron of all four planes can be effected by striking with the hammer on the same part of the plane as was struck on the bench, but the hammer tends to spoil the plane, and tradesmen who take a pride in their tools are particular how they strike their planes with the hammer on account of the danger of disfiguring them.

The setting up of the planes next occupies us, and again we take the two larger planes first. Grip the plane (try or jack) with the left hand, and resting the plane end on the bench, with the thumb in the throat (see Fig. 9),

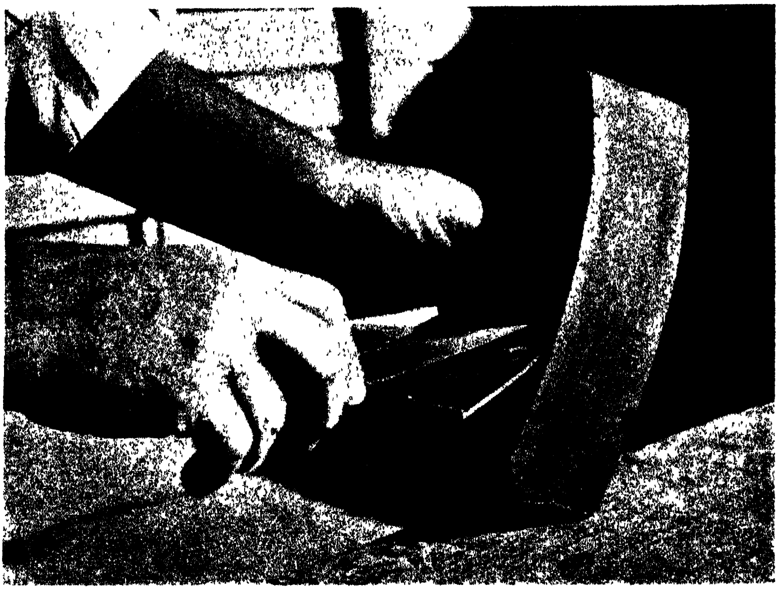

Fig. 13.—Inserting the Iron and Wedge in the Smoother.

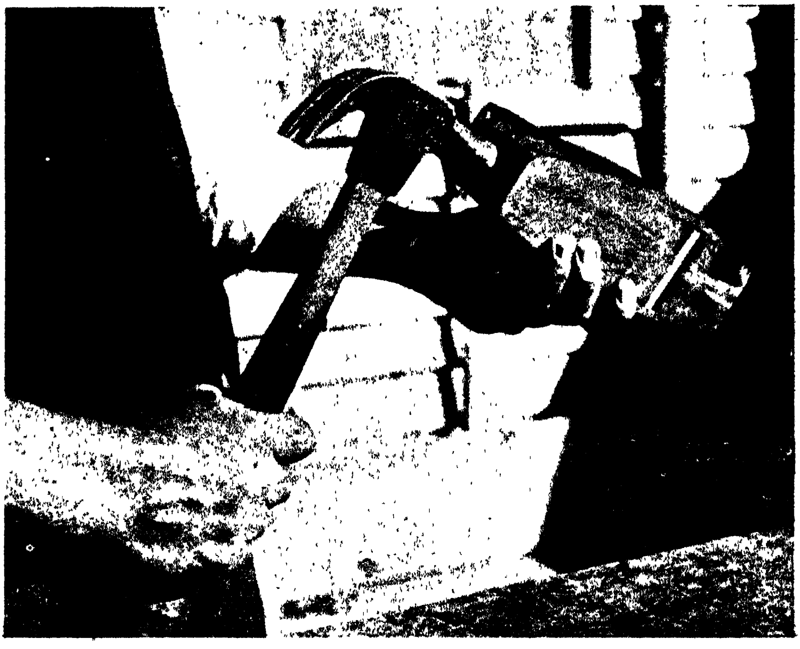

Fig. 14.—Drawing the Iron back a shade

The method is the same for Smoother and German Jack Planes.

take the irons and slip them into position, holding them with the thumb; now slip the wedge into position, still keeping the thumb of the left hand on the irons, but so that the points of the wedge slip up on either side of the thumb. Then with the hammer give the wedge a light tap—just enough to hold the irons in place (Fig. 10). Now turn the plane over and sight it along the sole to see how the iron is. It will be observed by the tyro how easily the plane is handled when gripped in the manner suggested. If the iron is too far out, give the plane (still held in the left hand, the thumb in the throat, and resting on the wedge and iron) a light, sharp tap with the hammer on the front top side. The plane must be struck quite square with the face of the hammer, so that it will not be marked (Fig. 11). The effect of the blow is to draw the iron back a shade. After each tap on the front of the plane, give the wedge a light tap (Fig. 10), to make sure that the iron does not fall out and get "gapped."

Turning now to the two smaller planes, the method of gripping them with the left hand is the same as with the larger planes. Slip the iron and wedge into position, as described, then give the wedge a sharp tap with the hammer, and inspect the sole of the plane as before (Figs. 10, 12, and 13). If the iron is too far out, still holding the plane with the left hand, as before, give the plane a light, sharp tap with the hammer on the back end of the plane (Fig. 14); this will draw the iron back a shade. If one corner of the iron projects more than the other, give the top of the iron a tap the opposite way, and again tighten the wedge. Finally, when the irons are set to satisfaction, give the wedge a couple of sharp taps, making the iron and wedge secure.

(To be continued.)

THE MENACE OF THE STARLING.

A PROBLEM which becomes steadily of greater moment to the farmer is that of reducing the losses caused by starlings. Owing to the absence of natural enemies and to the semi-domestic habits of these birds, they thrive where our own birds disappear. Nor, apparently, is this state of things peculiar to Australia. According to the latest reports from Great Britain, enormous swarms of starlings fly over from the continent of Europe into England and Scotland, and the pest is becoming so serious that at Christmas time nurserymen are unable to collect any holly, mistletoe, or other berries on account of these birds eating them all. The birds are also a pest of fruit and some of the grain crops.

The combat with starlings would appear to be essentially a task calling for co-operation among farmers themselves if the effort is to be crowned with success. In the first place all houses should be made starling-proof, for it is in their roofs that the greatest percentage of the starlings is bred. The only other means of dealing with the pest are shooting and poisoning, and whichever of these may be favoured should be carried out on systematic and concerted lines if it is to have an appreciable effect.—W. W. FROGGATT, Government Entomologist.

Poultry Farming on the Northern Rivers.

E. HADLINGTON, Returned Soldier's Settlement Branch.

THE problem of making poultry-farming a profitable line for residents on the Northern Rivers has often been discussed, and the suggestion has been made that the Department of Agriculture should undertake the organisation of the industry. A little reflection upon the practical difficulties that present themselves in connection with such a movement, however, and of the far more real advantages that would attach to a movement that came from the producers themselves will convince most who know the conditions that the latter is much the more desirable course, and the one that is likely to be the more successful.

The preliminary question, however, is: Will poultry-farming pay on the rivers?

To answer that question we have to consider the handicaps of transit, food supplies, and other drawbacks incidental to the industry on the Northern Rivers. Owing to the scattered nature of the interests involved any organisation would be difficult and of slow growth. At the present time there is practically no specialised poultry-farming carried on there, and poultry are kept mainly as a side-line, or for domestic purposes, or as a hobby. Whether much of such poultry-farming is profitable or otherwise may be open to debate.

Under what may be called "side-line" conditions there is an almost insurmountable difficulty in connection with the proper collection and marketing of eggs. The small number of eggs produced on any one farm during the slack laying season (March to August) is perhaps the greatest obstacle to such a systematic marketing of eggs as would ensure them arriving in Sydney in a condition that would enable them to command remunerative prices. Again, in the summer time, when eggs are more plentiful, the scattered nature of the sources of supply, the unsystematic manner in which most of the eggs are collected on the farm, and the fact that a large proportion of the eggs are marketed per medium of the storekeeper, all constitute serious handicaps to landing eggs in Sydney in a fresh condition. However, organisation and initiative have overcome great obstacles in the past in the case of other industries, and a marked improvement in this one should be possible.

As an instance of what has been done in a small way, Grafton Experiment Farm may be mentioned. In the past eggs have been sent to Sydney and have commanded within one penny per dozen of new-laid egg prices. Contrast this with the almost regular quotation for "river eggs," 4d. to 6d. per dozen below "new laid." Here we have ample evidence of what better methods might and could produce under specialised poultry-farming conditions.

Taking a superficial view of the conditions, it seems hardly possible to compete successfully with poultry-farmers situated within 50 miles of Sydney, but if specialised poultry-farming were found to be profitable on the Rivers, even a small number of such farms might form a nucleus which would change the whole outlook and bring about improved methods of collection and marketing. This appears to be the only hope of any organisation among producers of eggs which would put them on a payable footing.

Factors to be Considered.

It may be as well in discussing this matter, in the first place, to point out that specialised commercial poultry-farming, as carried on around Sydney, is just a payable proposition, having no fortunes attached to it, and it is considered that these farms produce probably 75 per cent. of the fresh eggs sold in Sydney or exported. Therefore, they are the governing factor with regard to prices of new-laid eggs. This being the case, the question arises: What advantages, if any, would accrue to the poultry-farmer on the Rivers that would compensate him for the drawbacks incidental to the distance from Sydney, and the inferior communications by which he is handicapped?

The crux of the position is food supply. Can poultry be fed cheaper on the rivers than in Sydney? If they cannot, then commercial poultry-farming is an impossible proposition here. I find that, comparing the present prices of poultry foodstuffs (the principal items of which would be wheat, maize, pollard, and bran) the cost of feeding is roughly 15 per cent. higher in these districts than around Sydney. It should be understood that the comparison is for the same class of feeding in both cases. It would also cost the poultry-farmer on the rivers 2s. per 36-dozen case for freight, &c., to Sydney, while the Sydney suburban poultry-farmers pay on the average about 1s. per case.

Altogether the extra cost of food and the higher freight on eggs, together with a 1d. per dozen less than new laids, amount to a disadvantage of, roughly, 20 per cent. on production. It will take some very substantial set-offs to balance these disadvantages.

Supplementary Foods.

The next question which arises is: "Has the river farmer any supplementary or cheaper food supplies available than the staple commodities mentioned previously; and, if so, are they regularly available?" The latter is an important point, because on a commercial poultry-farm it does not pay to be continually changing the diet of the birds to meet intermittent supplies of commodities which, though, perhaps, good poultry foods, owing to the hens not being accustomed to them, would not pay as feed. A change of feed mostly puts the hens off laying, so that what may appear to be a cheap food might in reality prove a non-paying proposition.

The question might be raised whether the birds could not be fed wholly on grain, but a recent feeding experiment at Hawkesbury Agricultural College would indicate that the production from birds fed in this way would be from 30 to 40 per cent. less than from birds fed on the ration used under commercial poultry-farming conditions.

Table Poultry.

So far we have only dealt with the egg products, but when we come to review the possibilities with regard to table poultry the position is more complex and less encouraging. Under the present methods of marketing, it amounts to this: When young cockerels or old hens have to be marketed they are collected from the different farms in a variety of ways, most of which entail some delay before the birds reach the boats. There is a two-days' journey before they reach Sydney, and there is the possibility of missing the sales on the day of arrival, with the result that the birds are for the most part what has come to be known as "coop sick," being much emaciated and scarcely fit for consumption. Such birds usually fetch about half the price that would be obtained for the same age, breed, and quality of birds if marketed within twenty-four hours.

This constitutes a very serious handicap to poultry-farming on the rivers, whether specialised or side-line, and, as a matter of fact, appears to be sufficient to make poultry-farming under present conditions unprofitable. On top of these low prices it costs the river farmer about 1s. 3d. per pair freight, while about 6d. will cover all ex-rail suburban consignments—a difference of 9d. per pair on top of 50 per cent. less per pair in price.

The whole prospect of poultry farming in the rivers districts is for the present bound up with the solution of these problems.

VITICULTURAL NOTES FOR SEPTEMBER.

It will not be out of place this month to remind growers to overhaul their spraying machinery, so as to be in readiness for the coming season. To those who have so far been fortunate enough to escape much damage from attack by downy mildew without having to resort to spraying may be added a few words of warning. Sooner or later growers who neglect to spray must be hard hit, for favourable conditions cannot last for ever. Downy mildew has come to stay, and in the writer's opinion it is the most destructive of all vine diseases in Australia to-day. One can safely say that if grape-growing is to be made a commercial success, spraying cannot be regarded as anything less than an absolute essential. Spray, and spray thoroughly, for spray spells insurance of your grape crop.—H. L. MANUEL, Viticultural Expert.

PROPAGATION OF ENGLISH HOLLY.

THE common English holly is propagated from seed sown in light soil in pans or boxes, or in sheltered beds in the open ground. The berries are collected as soon as they change colour in May or June, and dried on a tray in the sun. They are then placed in a close-fitting tin, with a dusting of fresh lime on them to keep away seed weevils. The sowing is made as soon as the ground becomes warm again in late spring—in New England not before November. The seedlings are transplanted in rows as soon as they are large enough to handle, and planted in their permanent positions when 9 to 12 inches high.—E. N. WARD, Superintendent, Botanic Gardens.

September Work in the Apiary.

W. A. GOODACRE, Senior Apiary Inspector.

THE manner in which bees will carry out their spring work depends to a large extent upon the condition in which the colonies have been wintered. Special care is used in the preparation of colonies of bees for wintering, not so much for the purpose of just getting them through the cold weather, but rather so that when the spring comes along they will have sufficient energy and vitality left to enable them to survive until brood emerges and there are ample young bees to take their place. Upon the care that has been expended on bees during the winter also depends their capacity to resist disease. Lowered vitality, due to the effects of bad wintering or to poor autumn conditions tends to a greater risk from "spring dwindling."

September is generally a very important month to the bee-farmer, it being usually anticipated that the bees will have got to the turning point. In most cases, if the colonies are normal, young bees will be emerging fairly freely to replace the old ones, and if weather conditions are favourable the colonies will generally be showing much activity and progress toward the end of the month. In warm localities (again granted favourable conditions) progress may be advanced to such a stage as to make it necessary to provide ample accommodation so as to minimise any tendency to swarming. It is not common, however, to see such early progress.

The prime tasks of the apiarist during September should be to give prompt attention to the stores of the colony, to see that such conditions prevail inside the hives as will allow of expansion of the colony, and, if practicable, to assist the weaker stocks.

As mentioned in last month's *Gazette*, bees use up a good deal of their stores when intense brood-raising is being carried on. If there is a shortage of stores, then the bees economise by rearing less brood. It sometimes happens that bees gather sufficient supplies to keep them going, but this should not be an excuse for leaving a colony short of stores, for we often get a change in the weather, following which the bees may not be able to get out to gather supplies for days. Colonies with a larger supply of stores than is necessary can usually be found, and frames of honey can be taken from these to assist colonies with light supplies. If it is not possible to even-up supplies in this way, the poorer colonies must be fed with sugar syrup, or with honey obtained from healthy hives.

The next important procedure is to see that the bees have good brood combs, so that the queen will not be compelled either to pass or lay in a comb which contains a large percentage of drone cells. Care must be taken to see that all combs the queen has to lay in are selected worker combs. If supers are left on the hives during winter, it is quite likely that on the opening up of the hives during spring the bees will be found in the supers with a brood nest in course of establishment. As this is the warmest part of the hive, this state of affairs is quite satisfactory and beginners should not endeavour to move the bees and brood down to the lower stories; it is better during the early spring to allow the bees themselves gradually to work the brood nest down. Of course, if a fair number of supers are on the hive, some of those under the bees can be removed, especially if they contain poor breeding combs. In this case the colony will still be situated in the top supers.

A number of weak colonies may be found in the apiary at this period, but it is generally found at the same time that many other colonies have made so much progress that the weak colonies worth saving can be given some assistance from the progressive and populous ones. The assistance is given by removing a frame containing some unsealed brood from the weak hive, and inserting in its place a frame containing a fair patch of brood (principally sealed) and adhering bees from the populous colony. Be sure not to remove the queen.

THE "PIG BREEDERS' ANNUAL."

"THE differences, in fact, from a commercial standpoint, between a good and a bad animal of any of the most renowned breeds are wider than those which separate well-shaped and scientifically-fed animals of different breeds Thus, all experienced pig breeders who seek to derive commercial profit from the production of bacon prefer pigs which are light in the fore-quarters, thick in the flank, square in the hind-quarters, well up at the tail, long in the back, and not too long on the legs. Bacon from such pigs, if they are wisely nurtured and fed, having due regard to their natural habitat and diet, need fear no serious competition from Denmark, the United States, or Canada, and still less from the porcine scavengers of China."

In that suggestive paragraph Lord Bledisloe prefaces the "Pig Breeders' Annual" for 1922, a useful volume, published by the National Pig Breeders' Association, London. For the Australian pig-breeder the interest of the book lies in a series of very well-informed articles on different aspects of the business, such as diseases of the skin, feeding, mineral requirements, systematic rationing, portable sties, and so forth, each of which discusses its subject in an instructive manner. It is interesting to read, for instance, that there are ten or twelve minerals that are essential to the health of an animal, not only as forming the bony skeleton, but as essential to the blood and soft tissues, to the beating of the heart, the respiration, the working of the nervous system, the processes of digestion and excretion, and the normal functioning of every organ of the body. How these substances may be best supplied is suggested in one valuable article.

Our copy from the publishers, The National Pig Breeders' Association, 92 Gower-street, W.C. 1, London. Price, 2s. 6d. net

Pure Seed.

GROWERS RECOMMENDED BY THE DEPARTMENT.

THE Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Potatoes:—	
Carman, No. 1	Alf. Piper, Llangothlin.
Coronation	A. Pannach and Sons, Mt. Excelsior, Lavington.
	E. M. Herring, "Sheen," Batlow.
Early Manistee	Alf. Piper, Llangothlin.
Factor	J. Piper, jun., Llangothlin.
	A. Pannach and Sons, Mt. Excelsior, Lavington.
Langworthy	K. Bowen, Newport P.O., Orange.
Surprise	Alf. Piper, Llangothlin.
*Symington	H. F. White, "Bald Blair," Guyra.
†Teasdale	B. C. Meek, Hobby's Yards.
Maize:—	
Boone County White	J. Chittick, Kangaroo Valley.
Cocke's Prolific	Manager, Experiment Farm, Lismore.
Early Clarence	F. T. Dowling, Tumut.
Fitzroy	Manager, Experiment Farm, Grafton.
	J. P. Mooney, Taree.
Funk's Yellow Dent	H. Manser, Sunnyside, Northern Line.
Golden Glow	J. F. Chick, Tenterfield.
	W. H. Waters, Burradoo.
Hickory King	L. F. Herne, Brundee, via Nowra.
Iowa Silvermine	J. H. Kerr, Little Valley, Elsmore, via Inverell.
Iowa Silvermine (2nd Quality)	S. C. Browning, Uralla.
Large Red Hogan	Principal, H. A. College, Richmond.
	G. E. Levick, Taree Estate, Taree.
Leaming	Manager, Experiment Farm, Grafton.
	J. Perrett, Miller's Forest, Hunter River.
Manning Silvermine	R. Dyball, jnr., Taree Estate, Taree.
Sundown (formerly North Western Dent)	J. S. Whan, Llangothlin.
Wellingrove	Manager, Experiment Farm, Glen Innes.
	J. S. R. Crawford, Emu Swamp, Orange.
Yellow Hogan	J. Booth, West Kempsey.
Lucerne:—	
Lucerne	H. A. Mace, Fairview, Pallamallawa.
Sorghums:—	
Feterita	Manager, Wagga Experiment Farm, Bomen.
Saccaline	Manager, Experiment Farm, Lismore.
	Under Secretary, Dept. of Agriculture, Sydney.

NOTES:—*Symington variety has about the same characteristics as to yield and size of potatoes as Surprise, and is otherwise similar, except that it shows a variation in the colour of the skin to Surprise.

†Teasdale variety is only cultivated in a small district, in which fairly good results have been obtained during the past few years. It is a white-skinned tuber, with pink blotched eyes.

Grasses:—	
Paspalum dilatatum ...	... Manager, Experiment Farm, Lismore.
Gramma:—	
American Pear	... R. Dyball, jun., Flettwood Bag, Taree.
Peanuts:—	
Chinese	... Manager, Experiment Farm, Grafton. Principal, H. A. College, Richmond.
Valencia..	... Manager, Experiment Farm, Grafton. Principal, H. A. College, Richmond.
White Spanish	... Manager, Experiment Farm, Grafton. Principal, H. A. College, Richmond. Manager, Experiment Farm, Yanco.
Pop Corn:—	
Black Beauty	... Manager, Experiment Farm, Bathurst.
White Rice	... Kable and Son, Orton Park, via Bathurst.
Sudan Grass:—	
Sudan Grass	... Manager, Experiment Farm, Temora. Manager, Experiment Farm, Yanco.
Broom Millet:—	
Broom Millet	... W. G. Chaffey and Sons, Tamworth.

AMERICAN DAIRY FARMERS FAVOUR TICK ERADICATION.

"WHEREVER the dairy industry has gained a foothold in the south there is a strong sentiment in favour of the complete eradication of the cattle tick, for it is only in tick-free areas that the dairy cow can be expected to return a profit."

So says the United States Department of Agriculture in one of its latest publications. It goes on to relate that last fall it had been decided in two counties in Mississippi State to stop the work of tick-eradication, but the cow-owners got together and demanded that the decision be reversed—so well had they come to know that dairying and the tick cannot get on together. Be it said, it *was* reversed too.

The Commissioner of Agriculture in the State of Oklahoma has issued a map showing that in an area of 43,000 square miles that has been cleared of ticks there are now more than 150 creameries and ice-cream factories that have sprung up in the last three or four years. Such conditions are never found, says the Department, in the domain of the tick.

IF the pig-keeper is to be successful in days of superfine tastes, he must systematise his industry through and through. The methods of pork production practised by our fathers are now of no avail, for there have been greater and more far-reaching changes in the public taste within the past twenty or thirty years than most of us will be ready, off hand, to admit; but it is just our ability to recognise such changes, and to alter our methods accordingly, that lie at the basis of successful pig-feeding.—*Irish Farmers' Gazette.*

Poultry Notes.

SEPTEMBER, 1922.

JAMES HADLINGTON, Poultry Expert.

THE unusually heavy rainfall of last month has had a depressing effect upon poultry interests generally, having affected adversely the usual seasonal laying expectations, and to some extent early rearing operations, particularly so where farmers have not had the advantage of good brooding equipment. On the other hand, where there has been a good class of equipment only small losses in brooding should have occurred as a result of the excessive rainfall. The experiences of many during the past month of inclement weather should be one more proof of the fact—so often stressed in these notes—that it pays to have the best possible brooding and rearing equipment one can afford.

In this connection one recalls the condition of the poultry industry in this respect only a short ten years ago. Then good brooding equipment was only to be found on a comparatively small number of farms—vastly different from the conditions existing to-day, when by far the greater number of commercial farms are fairly well equipped in this particular.

Whatever losses may have occurred this season, they are insignificant compared with what would have occurred ten years ago under similar weather conditions. As things are now on well-equipped commercial farms, the rearing of chickens has been lifted from a haphazard "catch-as-catch-can" operation to an art where the skill and aptitude of the operator is largely the determining factor.

Still, much remains to be done by way of consolidating experience and bringing about uniformity of practice on the best lines. The multiplicity of ideas on brooding, as on other matters in connection with poultry culture, is a great burden upon the poultry industry, and the beginner will do well to protect himself in this respect. It has been the aim of the Department to simplify and systematise the work of the poultry-farmer, and to demonstrate methods that are actually successful. For this purpose a demonstration poultry section was established at Hawkesbury Agricultural College, and this section is open for the inspection of poultry-farmers and of those who intend to take up poultry-farming. During the next few months is the best time to make such a visit. Intending visitors should communicate with the Principal as to the day on which the inspection may be conveniently made.

Close the Hatching Season.

This month should see the hatching season brought to a close. The temptation to prolong hatching into October is well understood. One may feel that the number of chickens to come out by the end of this month is short of his objective or desire, but the question is, what is the use of hatching chickens that are more than likely to be unprofitable. It is safe to estimate that 90 per cent. of chickens hatched during the months of October, November, and December will never return a profit. On the other hand, they will mostly result in loss and be a menace to the farm, inasmuch as late-hatched chickens are most susceptible to disease.

It follows, then, that it is inadvisable to set eggs, on a commercial scale at any rate, after about the 10th of this month.

Rearing.

The warmer weather that might now be expected will solve some of the brooding troubles that have been experienced in the earlier months, but it will bring other troubles, principally those arising out of attempts to pass too many chickens through a limited equipment. This is one of the weaknesses incidental to poultry-farming. To secure the number of chickens wanted, or as many as possible, the farmer not infrequently takes risks with regard to the number of chickens put into the brooder units or weaning section, as the case may be. Sometimes he gets through without any serious mishap, but in far the greater number of cases this practice results in disaster, or at best entails a loss of development that in turn means loss in profits, and—what is worse—a risk of disease.

The chicken-raiser should consistently keep in mind the fact that prevention of sickness is his only chance of successful rearing. The chicken life is so tender as to render curative measures almost futile. More attention should be paid to preventive measures, such as supplying adequate temperatures to prevent chills, keeping only reasonable numbers in each batch, feeding on simple food, and ensuring good sanitation.

How to carry out these simple rules is told in " Rearing and Feeding," available to poultry-keepers gratis from the Department, and need not be reiterated here.

A Vital Issue.

One of the most vital issues to the poultry-farmer is the class of development secured in rearing. An object lesson on this subject was recently demonstrated at Hawkesbury Agricultural College, when 150 chickens were divided into lots of fifty each, all brooded in the same line of brooder units under the same temperatures, but fed differently.

Two lots were fed on dry grain food, and one lot on the usual formula for feeding chickens, which is the ration advocated by the Department. The usual green food was supplied to each lot. The result was a surprise even to Mr. Lawrence, the instructor at the College.

On weighing the chickens of each lot at a month old the two grain-fed lots weighed less than half the chickens fed on the usual ration. The difference in favour of the pollard and bran wet-mash ration (with one feed of chicken mixture for the evening feed), was almost incredible, but anyone inspecting them could see a remarkable difference in growth.

The result is quite in accordance with my own experience, extending over twenty years, in feeding chickens on a big scale, and indicates that it is not possible to get anything like the same development with grain only as when feeding for the greater part of the day with moist mash, and particularly when the mash is mixed with milk.

Dealing with Small Cockerels.

Since the publication of last month's notes, interest has been intensified on the subject of the disposal of table poultry, and questions have arisen as to the prospects of fattening cockerels, both for local consumption and for export. A good deal might be said on this subject, but before any systematic fattening of table poultry is possible a more appreciative attitude of poultry-farmers towards the possibilities in this connection will have to come about. There are two courses open to the egg-farmer. One is to dispose of the cockerels as soon as the sex can be distinguished, and the other is to rear them to the age and weight required by the market, whether as grillers or as roasters. The season of the year and the incidence of the market will be the determining factors in this connection. Generally speaking, good plump grillers make good prices up to October ; after that there are too many of them coming on to the market, due to poultry-farmers' anxiety to get rid of the cockerels. The consequence is, a slump takes place, and it often turns out that there has been a loss on rearing.

The next possibility is to rear most of the birds to a more advanced stage to be sold later as roasters. Many aver that this does not pay, and it must be admitted that this may be true in some cases. However, any system that would regulate the number of the different classes coming on the market would change the whole outlook, though it is certain very little improvement will take place until it is recognised that as far as the great bulk of the cockerels sent to the market is concerned, there must be an improvement in the growing of them. Herein lies the crux of the whole question: that the birds are often not well grown, and that very little attention is paid to them will be readily admitted.

Improved Methods.

A suggestion has been recently put forward that after the griller market has become satisfied (and over-done), there should be some scheme whereby the surplus of small birds should be taken off the market and sent to a fattening establishment. Personal knowledge and some experience on this subject, convinces the writer that any such attempt would fail on account of two serious factors—possibly three. The first is that very many of these small birds are so badly grown that they would prove almost impossible material to fatten. The second is that many of the birds have passed through such vicissitudes during collection and transit that they are not good material to operate upon. The third is the possibility of fowl tick being introduced into the establishment, as it would not be known where the chickens came from.

It appears to me that a practical scheme might be evolved whereby poultry-farmers would sell their surplus cockerels at six weeks old direct to some establishment laid out as a specialised business for growing, if not fattening cockerels. Such a business in the hands of capable rearers might prove profitable, and because of the advantage that would accrue to the industry as a whole, it might be subsidised by poultry-farmers to the extent of making up any loss for the first two or three seasons. This might be the means of altogether changing the outlook with regard to table poultry, both for local consumption and for export.

In conclusion, a scheme for growing cockerels from six weeks old to the age and weight required should be practicable if handled direct from the farm of origin to the farm where they are to be grown. I fear that any scheme to take such young birds off the market would not succeed.

A WARNING ABOUT DOWNY MILDEW OF THE GRAPE VINE.

WITH the approach of the growing period, and in view of last season's serious outbreak of downy mildew in the Hunter River district, the Department of Agriculture urges upon vinegrowers the importance of an early start with the spraying campaign.

It has yet to be realised by many growers that this disease is in Australia to stay, and that it is absolutely essential that spraying should now become a part of the routine of grape growing. The disease develops under less humid conditions, and spreads more rapidly than black spot, and therefore demands continual activity and vigilance. In a dry season there will probably be little appearance of it, but it spreads so rapidly, and does such extensive damage if the conditions become favourable, that the grape-grower should regard spraying as essential to him as fire insurance is to the city business man. The cost of the spraying is small compared with the loss that neglect may entail, and though the operation is somewhat irksome and inconvenient, early and thorough treatment has the merit of being a certain control.

The first indications on the leaves of the presence of the disease are dark, oily-looking patches on the upper surface, which later turn yellow and then brown. Upon the lower surface the spots are not at first so evident, but very soon they present a whitish, downy appearance—the "downy mildew." The first sign of the trouble on the fruit is a hardening of the berry, together with a change from its normal colour to a greyish-blue lead colour.

Bordeaux mixture is the most effective control, and an endeavour should be made to keep a coating of the fungicide continuously upon the vine to prevent infection. The principal formula for Bordeaux mixture is as follows:—Bluestone (copper sulphate), 6 lb.; lime (freshly burnt), 4 lb.; water, 40 gallons or 50 gallons. Bordeaux mixture must be applied *before* the disease makes its appearance, in order to ensure adequate protection. The first spraying should be given when the shoots are about 9 inches long—not later. As new growth appears the vines should be resprayed—roughly at intervals of about two weeks. In some vineyards as many as six applications of spray are made. It is important that the Bordeaux should be freshly made when applied.

In abnormally bad seasons Bordeaux mixture, made to a strength of 10-5-50, may prove an advantage.

The Department of Agriculture has a well-illustrated leaflet on the subject, of which growers can have free copies on application to the Under-Secretary and Director.

Orchard Notes.

SEPTEMBER.

W. J. ALLEN and S. A. HOGG.

Cultivation.

THE ploughing should now be completed. It is essential from now on to keep the orchard well cultivated and free from weeds, as it is during the growing period that the trees require sufficient moisture to produce and retain their fruit.

Where young trees have been planted this year, it is advisable to hoe round them, loosening the earth to within a distance of 2 feet from the trees. This is not sufficient, of course, a general cultivation being also recommended. Where young trees have been planted as refills in an old orchard, special attention is required. It is also advisable to mulch the ground around the young trees, using well-rotted stable manure, leaf-mould or decayed vegetable matter, taking care not to allow the mulch to come in contact with the tree, as it is very apt to set up gumming on the stock, and thus to cause the death of the trees. This is a frequent error, and special attention is drawn to the necessity for applying the mulch as stated.

Most trees will be blossoming this month. It is frequently noted, particularly where pear, plum, and apple trees are isolated, that they blossom and set their fruit, but as soon as it has attained a certain size it drops off. This is mainly due to lack of fertilisation; that is to say, those particular varieties are self-sterile and unable to fertilise themselves. In such cases much success may be obtained by artificial fertilisation.

The method adopted is as follows:—Obtain some blossom from another tree of the same species, but of a different variety, which happens to be blossoming at the same time as the sterile tree. Place the blossoms in a can of water and stand it in the middle of the tree, or they may be shaken over the sterile flowers, taking care to shake the blooms that are to be introduced on the windward side, if a slight breeze is blowing.

Spraying.

In some of the earlier districts, apple and pear trees will be ready for their first spraying as a check to the codlin moth. Arsenate of lead should be used, and it will be found an advantage also to mix some casein with the spray to act as a spreader. The proportion generally used is 5 oz. of casein to 50 gallons of solution.

If the apple trees have suffered from powdery mildew, it would be advisable to give a combined spray. This may be done by adding atomic sulphur to the arsenate of lead. In districts where apples are subject to black spot, lime-sulphur (summer strength) may also be combined with arsenate of lead.

If there is any sign (upon examination) of either black aphis or of leaf curl on the peach trees, they should be immediately sprayed.

With regard to the leaf curl, it has been found that the best results have been obtained by spraying with lime-sulphur during the dormant stage, say, in July. If this has been overlooked, then a weak application of lime-sulphur should be applied directly the disease is detected, using it in the proportion of 1 in 28, according to the formula contained in the Department's pamphlet dealing with lime-sulphur.

With regard to the black aphis, a concentrated nicotine solution should be used, or a preparation should be made up in the orchard from tobacco stems, adopting the method mentioned in the leaflet regarding tobacco washes.

Apricots and almonds are subject to the attacks of the fungus disease known as shot-hole. If these trees have not been sprayed with Bordeaux mixture during the winter or just before the buds burst, they should be given an application during the early growing period with Bordeaux mixture (summer strength.)

San José Scale.

From observation, there is every reason to believe that this pest is spreading, particularly along the coast. Owing to the difficulty of detecting its presence it is frequently overlooked until the limbs either begin to wither or completely die. If at any time the trees are showing a lack of vigour and odd twigs or branches are dying back, they should immediately be carefully inspected in order to ascertain the cause.

This scale first makes its presence evident as very small, dark, bluish-black dots. It then gradually grows and increases to about one-sixteenth of an inch in diameter, disguising its presence by adopting a covering very similar in colour to the wood it is attacking. This is why it is so difficult to detect.

Another sign of its presence is the formation of little pink dots on the fruit, particularly apples and pears, although there are some varieties of apples to which pink dots are natural, and these should not be confounded with the markings of this particular scale.

Winter treatment is the most effective for this pest, either miscible oil or lime-sulphur being used. If the presence of San José has not been noticed until later in the growing period, a weak solution of lime-sulphur may be applied. This will act only as a check, as during this period a solution sufficiently strong to kill the scale cannot be used.

Peach-tip Moth.

It is during the early period of the growth of peach trees that the presence of this insect may be noticed. The orchardist's attention may be drawn to the tips of the peach trees by the withering of the terminal leaves Directly this is noticed the tips may be removed to a length of at least 2 inches (and either burnt or boiled). If this is not done the little grubs eat their way down through the slender tips and frequently attack the fruit, preferring, as a place of entry the point where two fruits touch. It is then, of course, too late to save the fruit, but it is advisable to have it picked and destroyed.

Budding and Grafting.

It will be rather late now in most districts for grafting, but in the later districts, where the sap has only started to flow and the buds are just bursting, grafting may be satisfactorily carried out. Where it is decided to work over old trees it is preferable to cut them down below the crown and to insert three or four scions, according to the diameter of the stock.

On the other hand, in the case of very vigorous trees, it may be an advantage to graft the limbs, leaving one limb ungrafted to assist in the absorption of the sap. If it is desired that the trees should be budded the branches may be cut hard back, that is to say, to within 3 or 4 inches of the crown. In the summer the branches that are to be permanently left should be selected, and the centre of the tree opened up so as to allow the light to penetrate and all superfluous suckers removed. This permanent growth may be budded sometime in January or February.

AN UNUSUAL INQUIRY.

AN inquiry as to what extent orange trees aged from 4 to 5 years would suffer as a consequence of having had a number of copper nails hammered into their trunks was replied to by the Government Biologist in the following terms:—"Copper nails hammered into a tree poison the wood immediately around them. Each nail becomes surrounded by an area of dead wood, and such dead areas weaken the power of the tree to resist high winds, and interfere with the flow of sap. A number of copper nails of the type submitted, if hammered into a young tree, would cause extensive permanent injury. In an older tree the same number of nails would not cause injury to the same extent, but it would be none the less definite."

The extraction of the nails where possible without injuring the bark was recommended, and the covering of the injured bark with wax or a light dressing of Stockholm tar.

THE COST OF A GRAPE-PRESSING PLANT.

THE following information was supplied by Mr. H. L. Manuel, Viticultural Expert, for the guidance of a correspondent who inquired as to the detailed cost of a pressing plant capable of treating one hundred tons of grapes per month:—

	Approximate Cost.
	£
1 Mill (grape)	50
1 Press (hand)	40
1 Must pump	50
1 Wire pump	45
8 Fermenting tanks (1,000 gallons) at £31	250
2 Racking tanks (800 gallons) at £25	50
Hoses and sundries	70
Engine shafting...	400
Storage casks and cement	375
Buildings	1,000

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1922.

Society.	Secretary.	Date.
Manildra P. and A. Association	J. Longley ...	Sept. 6
Northern A. Association (Singleton)	J. T. McMahon ...	,, 7, 8, 9
Hills District Fruitgrowers' Association (Galston) ...	B. F. Renant ...	,, 8, 9
Cootamundra A. P. H. and I. Association	Wm. A. Sowter ...	,, 12, 13
Cowra P. A. and H. Association	E. P. Todhunter...	,, 12, 13
Ganmain A. and P. Association	A. R. Lhuede ...	,, 12, 13
Albury and Border A. and H. Society	A. G. Young ...	,, 12, 13, 14
Canowindra P. A. and H. Association	John T. Rue ...	,, 19, 20
Holbrook P. A. and H. Society	Jas. S. Stewart ...	,, 19, 20
Temora P. A. H. and I. Association	A. D. Ness ...	,, 19, 20, 21
Deniliquin P. and A. Society	P. Fagan ...	,, 20
Burrowa P. A. and H. Association (Boorowa) ...	W. Burns... ...	,, 21, 22
Murrumburrah P. A. and I. Association	W. Worner ...	,, 26, 27
Henty P. and A. Society	H. Wehrman ...	,, 26, 27
Narrandera P. and A. Association	W. H. Canton ...	,, 26, 27
West Wyalong P. A. H. and I. Association	Thos. A. Smith ...	,, 26, 27, 28
Condobolin P. A. H. and I. Association	H. Monro ...	Oct. 3, 4
Walbundrie P. A and H. Society	W. Goldsworthy ..	,, 4
Hay P. and A. Association	C. L. Lincolne ...	,, 4, 5
Berrigan A. and H. Society	R. Wardrop ...	,, 10
Tweed River A. Society (Murwillumbah)	T. M. Kennedy ...	Nov. 22, 23

1923.

St. Ives A. and H. Association	A. K. Bowden ...	Jan. 12, 13
Kiama Agricultural Society	G. A. Somerville...	,, 25, 26
West Bargo A. H. and I. Society	L. J. C. Hicks ...	,, 26
Wollongong A. H. and I. Association...	W. J. Cochrane ...	Feb. 1, 2, 3
Inverell P. and A. Association	A. L. Varley ...	,, 6, 7, 8
Tahmoor and Couridjan	E. S. Key ...	,, 9, 10
Yanco A. Society (Leeton)	W. M. Evans ...	,, 13, 14
Shoalhaven A. and H. Association	H. Rauch... ...	,, 14, 15
Guyra P. A. and H. Association	P. N. Stevenson...	,, 20, 21, 22
Nepean District A. H. and I. Society (Penrith) ...	C. H. Fulton ...	,, 22, 23, 24
Newcastle A. H. and I. Association	E. J. Dann ...	,, 27, 28, Mar. 1, 2, 3
Robertson A. and H. Society	E. S. Martin ...	Feb. 28, Mar. 1
Moruya A. and P. Society	H. P. Jeffery ...	,, 28, ,, 1
Oberon A. H. and P. Association	C. S. Chudleigh ...	Mar. 1, 2
Central New England P. & A. Assoc. (Glen Innes) ..	Geo. A. Priest ...	,, 6, 7, 8
Tumut A. and P. Association	T. E. Wilkinson ...	,, 7, 8
Bangalow A. and I. Society	W. H. Reading ...	,, 7, 8
Hunter River A. and H. Assoc. (West Maitland) ...	J. S. Hoskins ...	,, 7, 8, 9, 10
Berrima A. H. and I. Society	W. Holt	,, 8, 9, 10
Campbelltown A. Society	J. T. Deane ...	,, 9, 10
Blacktown A. Society	J. McMurtrie ...	,, 9, 10
Mudgee A. P. H. and I. Association	S. H. Somerville ..	,, 13, 14, 15
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Agricultural Gazette of New South Wales.

The Eradication of Cattle Tick.

THE NEED FOR UNITED EFFORT.

C. J. SANDERSON, Chairman, Tick Board of Control, Lismore.

THE eradication of the cattle tick from the north-eastern corner of New South Wales is of prime importance to that portion of the State. Many dairy farmers are still unaware of the serious losses inflicted by the pest, of the further dangers that its presence involves, and of the urgent necessity for extruding it from the State.

They have only to consider the losses caused by the pest elsewhere, however, to be convinced that the campaign against the tick should go on until the area has been absolutely cleaned up.

The loss from deaths caused by tick fever in Queensland alone has been estimated at over £7,000,000, to say nothing of the losses in the Northern Territory and Western Australia. The decrease in the value of leather production in Queensland amounts to over £100,000 more, and the additional losses caused by tick worry, the reduction in natural increase, poor growth, loss of condition, diminished yield of milk, butter, meat, and so forth, quite apart from the cost of efforts at control and consequent disorganisation of the cattle-raising business, must bring the total to a huge one.

Though not all the worst features of tick infestation are to be found in New South Wales, those which directly affect the cattle-owners of the north-east quadrant are probably quite enough to represent a very startling sum if they could be ascertained in full. Happily, the measures of control always enforced have been sufficient to protect farmers from the worst consequences of the presence of the tick, but the fact has to be faced that while the tick remains on our soil it constitutes a continual menace.

Life History of the Tick.

As a preliminary to the intelligent and successful application of methods of eradication, it is necessary to know the life history of the tick and the influence of temperature, moisture, and other climatic conditions on the various stages of its existence.

Ticks pass through the following stages:—

1. The egg.
2. The larva.
3. The nymph.
4. The adult.

1. *The Egg.*—The adult female tick (Fig. 1) drops from the host before she commences to lay her eggs, which she then deposits in great numbers (4,000 to 5,000) in a large coherent mass upon the ground. Thereafter, the

eggs receive no care from the parent, which dies shortly after all the eggs are laid (Fig. 2.) When the engorged female drops to the ground she hides in moist earth beneath leaves or other litter, which serve as a protection from the sun or frost and numerous enemies. The female tick may be eaten by birds or destroyed by ants, or she may perish as a result of unfavourable conditions, such as frosts, absence or excess of moisture, and many other conditions. Egg-laying (Fig. 2) begins in spring, and may occur in the summer and autumn months, in from two to twenty days after the female has fallen to the ground. In winter egg-laying only commences in from thirteen to ninety-eight days after falling. The eggs are small, elliptically-shaped bodies, about one-fiftieth of an inch in length, at first of a light amber colour, later changing to dark brown. Egg-laying is greatly influenced by temperature, being retarded or even completely arrested by low temperatures. It is completed in from four days in the summer to 151 days beginning in the autumn. In from nineteen days in the summer to 188 days during the autumn and winter, the eggs begin to hatch.

2. *The Larva.*—From each egg emerges a small oval, six-legged larva or seed tick (Fig. 3.) After a few days these crawl up the stems of grasses or other plants, usually to the topmost leaf, awaiting a host. They take no kind of food, and, consequently, do not increase in size, and are capable of fasting from five months in the summer to nearly eight months during the colder part of the year, but unless they become attached to a host they die of starvation. As soon as the host is secured, they take their first meal, becoming considerably distended, after which the first moult takes place (Fig. 4), and the 8-legged nymph stage is reached. The larva has no breathing organs.

3. *The Nymph* (Fig. 5.)—This stage, in which the tick closely resembles the adult, is employed in feeding on the host, during which the body of the tick still further increases in size, though it is still quite small. When replete it moults its skin a second time, and appears as the sexually mature tick. The nymph has breathing organs *but no sexual organs*, and until after the second moult the sexes cannot be distinguished.

4. *The Adult.*—Immediately after the moult from nymph to adult, the male and female are usually identical in size, and still quite small. The male (Fig. 6.) emerges from his skin as a brown oval tick, about one-tenth of an inch in length. He has reached his maximum, and goes through no further development. Little change takes place in the adult male after feeding. Copulation generally takes place when the female is small. The male shows great activity, moving about more or less over the skin of the host, but the female seldom moves from her original point of attachment. After mating, the female increases very rapidly in size, and in from twenty days after becoming attached to the host as a seed tick she becomes fully engorged (Fig. 1), and drops to the pasture to start again the cycle of development by laying eggs.

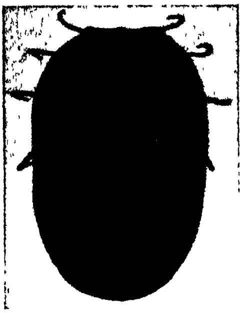
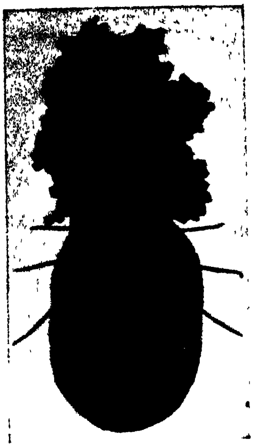


Fig. 1.



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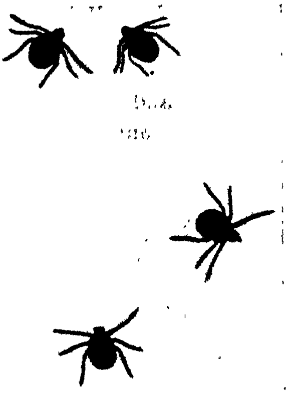

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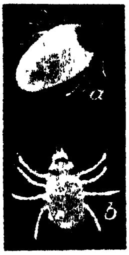

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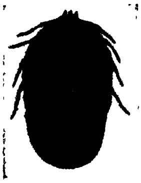

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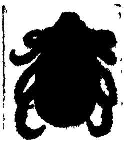


Fig. 6.

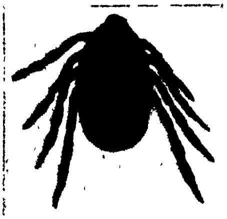


Fig. 7.

Cattle Ticks in Various Stages.

[*From Farmer's Bulletin*, 378, *United States Department of Agriculture*.]

Fig. 1. Full-grown female tick, engorged and ready to drop to the ground and deposit eggs (magnified 3 times). Fig. 2.—Tick laying eggs. One tick may lay as many as 5,000 eggs (magnified 3 times). Fig. 3.—Larvæ, or seed ticks, after emerging from the eggs (magnified 9 times). Fig. 4.—Young ticks (*a*) before, and (*b*) after their first moult. At this stage the ticks have attached themselves to a host (cow, steer, or bull) and have changed from brown colour to white. Before the moult the young tick has six legs, and afterwards it has eight (magnified 9 times). Fig 5.—The nymph stage. The young tick is ready now for the second moult (magnified 6 times). Fig. 6.—Adult male tick (magnified 6 times). Fig 7.—Female tick after the second moult. This tick is now mature and slightly larger than the male, but she will presently increase greatly in size, then detach herself from the cow or steer and drop to the ground to lay her eggs (magnified 6 times).

Remarks.—From this short description it will be seen that engorged ticks dropping from the cattle, infest the pastures, and that, by means of the seed ticks which develop on the ground, cattle are continually reinfested.

Another point of considerable importance is that, until the tick has moulted twice—which takes about twelve days from the time that, as a seed tick, it became attached to the animal—it has no sexual organs and, consequently, cannot breed.

Still another matter that must be noted is the great difference in length of time which may occur between the time the engorged tick falls on to the pastures and the time when the seed ticks develop. Engorged female ticks dropped on pasture in the autumn may, and frequently do, cause cattle to become infested during the following summer, owing to the fact that egg-laying and hatching have been delayed by the low temperature of the winter season. Such occurrences are usually ascribed to fresh infestations, whereas they are due to treatment (dipping) having been discontinued before all the ticks in the pasture have been destroyed or have been starved to death.

Methods of Eradication.

Our knowledge of the life history of the tick shows clearly the means by which it can be eradicated. The pest may be attacked in two locations—on the pasture, and on the cattle. In freeing pastures, the method followed may be either a direct or an indirect one. The direct method is to exclude all cattle and horses from pastures till all the ticks have died of starvation. This method is impracticable in New South Wales, as, to ensure success, the pastures would have to be kept free from stock for too long a period. The indirect method consists of permitting the cattle and horses to continue on the infested pastures and of dipping them with agents destructive to ticks at such regular intervals as will prevent engorged females from dropping and reinfesting the pasture. By continuing the dipping over a sufficiently long period the larvæ on the pasture, or those which hatch from eggs laid by females already there, will all eventually be destroyed. Those getting on the cattle from time to time will be destroyed by the dipping, while those which fail to find a host will die in the pasture from starvation.

Numerous experiments have been made to discover the most effective agent for the destruction of ticks, and as a result, it has been proved that arsenic in proper solution is the safest, cheapest, and most effective agent for the purpose. The strength of the arsenical solution which has been adopted to destroy the cattle tick in practically every country where ticks exist, is 8 lb. of arsenic to 400 gallons of water.

During the investigation of the effects of arsenic it was found that the younger the tick the more easily it is destroyed. Ticks in the larval and nymphal stages are invariably destroyed by one dipping, whereas adult females have been found to survive after dipping.

Further light was thrown on this matter by the experiments conducted by Mr. L. Cohen, of the Department of Agriculture. This investigator found that in treating cattle infested with ticks of all ages a certain proportion of ticks always survived dipping, even when the strength of the dip mixture was raised to 12 lb. of arsenic to 400 gallons of water. He likewise made the discovery that the ticks that escaped destruction were invariably those that were in the second moult stage.

All the knowledge we possess, either of the life-history of the tick or of the effects of arsenic in its destruction, point to early dipping as the only sure means of *quickly* and *certainly* eradicating the pest.

As previously pointed out, ticks are not capable of breeding before the second moult and are readily destroyed by one dipping. Obviously, then, this is the best time to attack them, and, in practice, dipping every fourteen days has been found most effective.

How long this treatment should continue depends on several factors. It has been pointed out that the Northern Rivers possess an ideal climate for ticks, and that the heavily stocked dairy farms there provide perfect breeding-grounds for the parasite. Fortunately, heavily-stocked farms are also the most easily cleansed when treated regularly at appropriate intervals, for the large number of cattle ensure that the ticks on the pasture are picked up, and if the cattle are dipped the minute ticks will be destroyed. The period during which dipping should continue in the majority of cases should be from the time ticks first appear in the spring till the end of the autumn.

Reasons for Eradicating the Cattle Tick.

The ill-effects suffered by cattle which are at the mercy of ticks fall naturally under two heads:—

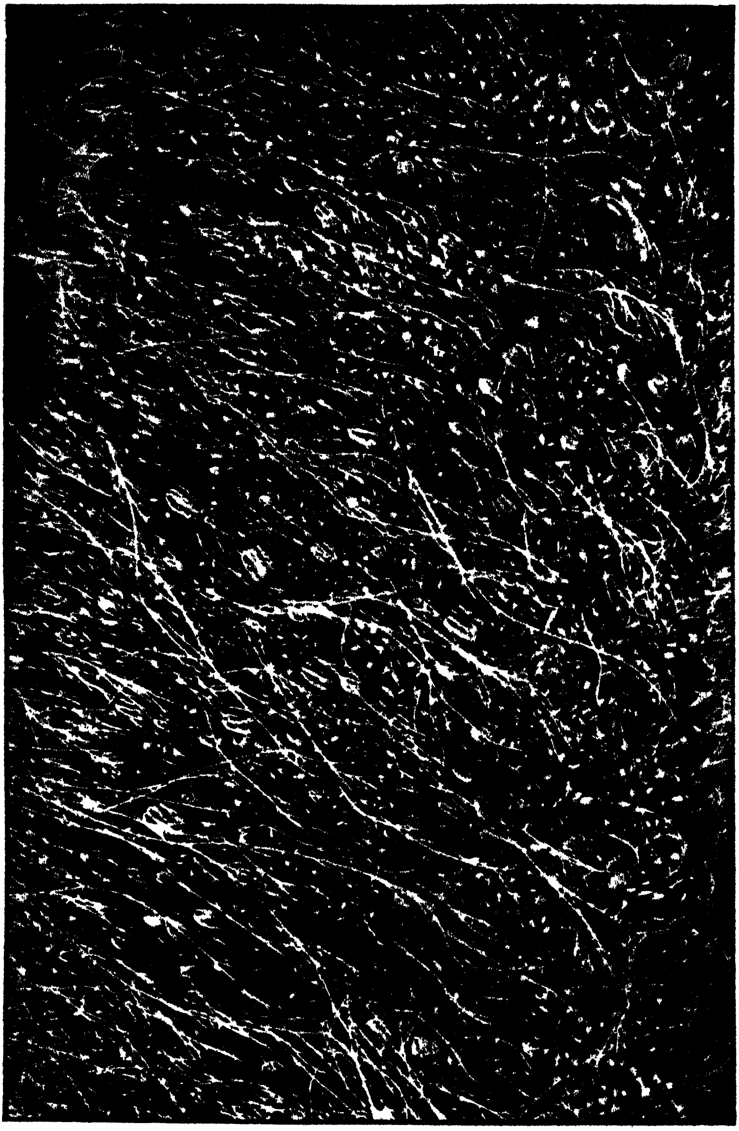
1. Serious loss of condition through the constant severe irritation and attendant loss of blood, which may become so severe as to result in death.
2. Diseases transmitted by ticks

In connection with No. 2, the cattle tick is the carrier of a dangerous germ, which it transmits to the blood of cattle, causing a disease known locally as tick fever or redwater. Without the tick there can be no redwater, and the surest way of preventing that very fatal disease is to eradicate the tick.

Fortunately, at present, the ticks found in New South Wales do not harbour the germ which causes redwater, but, as one infected living female tick may be sufficient to reinfect a large district, it is clear that nothing short of a system which would annihilate the very last individual tick could have any hope of complete success in preventing loss from redwater.

While a small number of ticks on a cow will appreciably reduce the quantity of milk given, a large number will cause her production practically to cease, while a heavy infestation will cause death from acute anæmia, the animal being bled white by ticks.

In the dairying districts of the Northern Rivers of New South Wales the most favourable conditions are present for tick life. Owing to the warm temperature and moisture which exist all the year round, the process of egg-laying and hatching is never interrupted, though it is, of course, slower in the winter season. While every farm is stocked up to its full carrying capacity, the majority are overstocked, and the number of ticks increases



Skin of a Bullock, grossly infested with Ticks.

Photo by Mr. C. J. Pond Government Bacteriologist Queensland. From Institute of Science and Industry, Bulletin No. 13.

in direct proportion to the number of hosts found on the farm. Thus, the more stock there are the more the ticks will increase, and under such conditions they may become so troublesome that, quite apart from their role as carriers of disease, they may do an enormous amount of damage by the withdrawal of blood from the stock, and by causing irritation generally known as "tick worry."

Put briefly, ticks (*a*) cause redwater, (*b*) reduce the milk yield of cows, and (in heavy infestations) even stop it entirely, (*c*) prevent cattle from fattening for the butcher, (*d*) ruin hides, and (*e*) make it necessary to impose quarantine restrictions in districts where they exist.

All these disabilities can be got rid of in a few months by the farmers uniting with the Government in a campaign against the pest.

What would happen if the Government abandoned Tick Control?

The work of tick eradication presents many problems, and the greatest problem of all is to induce many people to take even a passing interest in the work.

As previously pointed out, the co-operation of the stockowner with the Government is absolutely essential for success, and especially so on the Northern Rivers, where the conditions are so favourable to the spread of the pest. The Government can direct the work and assist in its general enforcement, but the details of its execution must always be in the hands of the people. If, therefore, from any cause the people do not co-operate, then the Government cannot continue year after year to spend large sums of money in attempting a work that is foredoomed to failure.

If the Government of New South Wales abandoned control in this area, ticks would spread rapidly to every holding, and owing to the favourable climatic conditions, would breed in countless numbers. Farmers would be compelled to dip their cattle in order to keep them alive, or they would be bled white by the ticks. Production of milk or fattening of stock could then only be ensured by frequent dippings, and that would continue till a more enlightened generation decided to get rid of a permanent tax on the industry by a united effort.

The installing of dips, purchase of medicament, mustering, and treatment of cattle would have to be carried out by and at the expense of the owner, and would be a very costly matter.

The work of tick eradication can only be successfully carried out by the united effort of the Government and the stockowner. Each is powerless without the other, but, working together, the pest can be suppressed in any given area in about a year.

The respective duties of both the Government and the stockowner can be clearly laid down.

The Duties of the Stockowner.

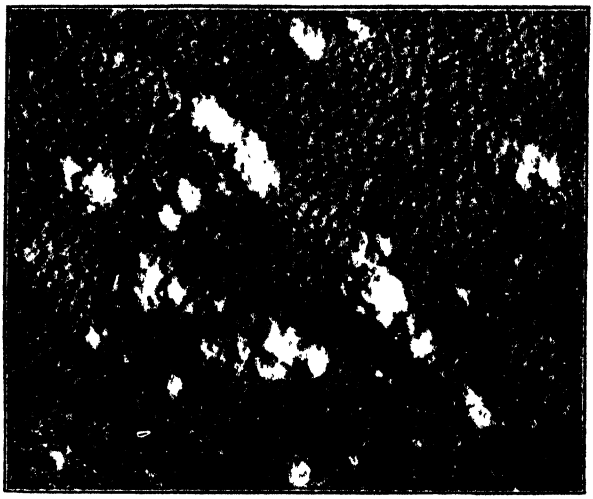
The stockowner who desires to see tick eradicated will consider it his duty—

1. To report ticks on his cattle to the nearest Tick Inspector;
2. To muster his cattle for inspection or treatment when ordered to do so by an inspector;

3. To keep his holding securely fenced, and to prevent his stock from straying:
4. To obtain a permit from an inspector on every occasion when he wishes to move stock from his holding.

If the presence of ticks on cattle is promptly reported by the owner, the outbreak can be prevented from spreading to fresh country, and can be quickly suppressed. In the past owners have, as a rule, neglected to report outbreaks, and this neglect has rendered the work of the tick staff doubly difficult, and, undoubtedly, has greatly contributed to the spread of the pest.

It certainly should not be too much to ask from a stockowner that he take sufficient interest in his stock to examine them at intervals for ticks, and to report if he finds them on his cattle.



Hide damaged by Ticks.

From Institute of Science and Industry, Bulletin No. 13.

When a farm is tick-infested, particular care should be taken to muster every hoof for treatment. The owner who neglects to obtain a clean muster will never get rid of the tick, as even to miss one infested beast from treatment will mean a fresh crop of seed ticks on the pastures, and will prolong the treatment for months beyond the time necessary for eradication.

It is quite impossible to get rid of ticks from any area in which stock are allowed to stray. The first consideration for effective work is control of stock, so that inspection and treatment can be carried out at the proper intervals. Straying stock may escape treatment for months, and, if tick infested, will spread ticks wherever they wander. The man who allows stock to stray is an enemy to the inhabitants of the district in which he lives.

The system of granting permits for stock movements is designed to prevent the chance of ticks being carried from one place to another. A permit to travel is only given when stock are clean.

Owners of holdings past which stock are being driven can demand to see the permit authorising the movement of the cattle, and so can assist in protecting their country from infestation.

In the past, the inspectors of the tick staff have been expected to discover ticks, to prevent straying stock, and to see that farmers fence and keep their fences in repair.

In the future, these matters must be undertaken by the stockowners themselves, as it is clearly their duty to obey the law which requires them to do these things.

Further, while it is an easy matter for each stockowner to inspect his own stock for ticks, prevent them straying, and to keep his fences in repair, it would require an enormous staff of inspectors to carry out this work in addition to their legitimate duties.

Dipping.—Although dipping appears to be a simple operation, if it is to be thoroughly effective, and not result in injury to cattle, certain factors must be taken into account.

Dipping or spraying should be carried out under suitable weather conditions. Rainy days should be avoided, for the reason that the rain-water tends to wash the dip out of the animals' coats and from off their skins. A bright, sunny day is perhaps the most suitable. Warm days, with a water-charged atmosphere - popularly termed "muggy"—should be avoided if possible. The early morning is the best time for dipping and spraying, as it allows plenty of time for the application to dry; but animals may be dipped at any time of the day, provided time is allowed for drying before they are driven, or, in the case of working bullocks, before they are yoked up.

Cattle should never be dipped when heated, tired, or thirsty. If they have been driven to the dip, they should be allowed time to cool and rest before they are dipped. The animals should be watered before dipping to prevent thirsty animals drinking the mixture as they pass through the dip.

A good means of preventing cattle from being attracted by the salty taste of the dip mixture, is to keep them well supplied with rock-salt.

Calves should not be dipped with their mothers for two reasons. In the first place, the cows would probably trample on the calves in the race, and in the dip itself they might drown them; and in the second place, the cows frequently lick their calves after dipping, thereby incurring the danger of arsenical poisoning.

After dipping is completed, allow the cattle to walk slowly back to their paddocks.

Spraying.—While spraying may be effective in destroying ticks under certain circumstances, it can only be regarded as a very bad substitute for dipping. In spraying it is necessary to pay particular attention to wetting the hollows of the ears, under the tail, between the udder and the legs, &c. Keep the pump going continuously, see that the mixture gets into all recesses, and spray the tail very thoroughly, particularly the brush.

Spraying is only suitable for quiet animals that can be handled, *as cattle cannot be sprayed properly in a crush.* The chance of missing patches of the animal on which ticks are attached is very great, and in the case of cattle with thick coats it is almost impossible to wet the skin. To effectively spray an animal takes at least two minutes, and, in addition, a great deal of time is wasted in mixing the dip solution in tins. When it is considered that 500 cattle can be dipped in an hour as against twenty-five to thirty that can be sprayed in that time, and, further, that the dipping is certain to wet the beast all over, whereas the spray is very liable to miss considerable portions of the skin, no reasonable man would prefer to spray when he could use a dip.

In Queensland there are over 3,000 privately-owned dips, and the cattle are dipped regularly. This fact should be quite sufficient answer to those people who suggest that dipping injures cattle. Dipping, if properly carried out, will not injure cattle, and an occasional dipping will even greatly improve stock by killing bush ticks and lice, which do them much injury.

The Duties of the Government.

The Government, after declaring a section of country quarantined for ticks, provides a staff of inspectors whose duty it is to control the movement of stock into, within, and out of the infested country, and to supervise the inspection and treatment of all stock in the quarantine.

In addition, the Department controlling the work manufactures the medicament, keeps dips charged, and conducts an analysis of the mixture in all dips (both public and privately owned) every three weeks.

The tick staff is organised to prevent ticks spreading to clean country, and for the eradication of ticks inside the quarantined areas. In doing this work it administers the Stock Diseases (Tick) Act and the regulations made under that Act.

The whole of the staff's time should be utilised for the purpose for which it was formed, but if, owing to neglect on the part of the stockowner to do his share, the tick staff have to cease their work to impound straying stock, or to prevent unauthorised stock movements, or to inspect fences, &c., it must be apparent that the work of eradicating the tick will receive a set-back.

The Government has clear evidence that the eradication of the tick is certain, provided some well-understood measures for its suppression are put into operation. What these measures are has been briefly outlined in the foregoing pages with the object of obtaining the assistance of the stockowner in putting them into force.

[The Department is indebted to the Institute of Science and Industry for the loan of the blocks used on pages 690 and 692.]

Last Season's Maize Yielding Contests.

THE LOWER NORTH COAST.

J. M. PITT, Inspector of Agriculture.

OPINIONS widely expressed by maize-growers and other members of the farming community on the Lower North Coast are to the effect that the maize-growing competitions inaugurated by the Department of Agriculture during 1920 must result in no end of good to the maize industry generally.

While there is always a certain aloofness on the part of the farmer, especially where a new experiment is to be undertaken, it seems safe to predict now—judging by the increased support forthcoming on both the Manning and Macleay rivers—that the success of the maize competitions in these districts is well assured. Contests of the kind were designed mainly with the object of eliminating many of the poorer-yielding varieties and of having those which have yielded best more widely grown; and while it is too much to expect far-reaching results so soon, a very decided move in the right direction is certainly discernible.

Even at this early stage many of the unsuccessful competitors realise that their varieties have not yielded up to expectations, and whilst it is hardly sound policy to condemn one's own maize after one failure, there is nevertheless a tendency on the part of certain farmers to sow at least a portion of their farms to seed of the leading varieties. Experience in our wheat-growing districts has shown that farmers quickly discard a low-yielding variety for one of higher-yielding qualities, and although changes may not be worked so rapidly by the maize-grower on the coast, there is little doubt that the low-yielding strains—too many of which are in evidence at the present time—will presently be dropped. The present high cost of production, coupled with the somewhat unsatisfactory state of the market for dairy and other produce, renders it almost absolutely necessary that the maize-farmer should grow those varieties of known high-yielding repute.

The outstanding feature of the competition has been the success of Large Red Hogan variety. Although grown successfully for many years on farmers' experiment plots, its adoption by maize farmers has been very slow—so much so that it is doubtful whether 5 acres on both rivers could be found at any time. Although not entered direct by the Department, as in the Macleay competition, the entries on the Manning were from seed supplied from Hawkesbury Agricultural College the previous year. Individual plot yields of 139, 131, 128, 119, 104, and 101 bushels per acre from the Manning and 104 and 101 bushels per acre from the Macleay are sufficient evidence of its yielding capacities. Although finishing second on the average, Manning Silvermine returned 149 bushels to the acre at Dumaresque Island. This is the highest authentic yield recorded in competition for the North Coast. The average yield of nearly 121 bushels to the acre for the winning variety is also a record for the Manning.

THE MANNING CONTEST.

Three plots were selected from the number offered by enthusiastic farmers. No. 1 was at Kolodong, on that portion known as the Wollar. It is one of the most fertile spots on the Manning, and on a farm owned by Mr. D. McDoneil. The soil was of a deep rich loam. Prior to 1920, when it grew its first crop of maize, the paddock had been under lucerne five years, and before that under pasture. After the 1920–21 maize crop the land was left in fallow during the winter months, cultural operations being impossible owing to the very wet winter. Ploughing took place early and late in September, followed by harrowings. The plot was sown on 7th October, 1921.

No. 2 was at Taree estate, another region noted for its extreme fertility, and on a farm owned by Mr. F. Brewer. The paddock had grown maize for many years previously. Cultural operations were commenced in August, and two ploughings, followed by harrowing, were given, the plot being in good order for sowing on 26th October. The soil was rich loam.

No. 3 was at Dumaresque Island, on the southern end, the land being owned by Mr. Percy Mooney. It was also a very fertile area. The soil here is not quite as heavy as at the other farms mentioned. Prior to 1919, the paddock had been under pasture; since then it had grown maize, late sorghum, and potatoes. Ploughings were given in August and September, and another prior to sowing. The seed was sown on 9th November.

In all instances drills were opened 4 feet apart, four grains were dropped every 3 feet by hand in the drill, and the seed was covered by the single-horse scuffler with the front and back tines removed—a very satisfactory method. Four rows of each entry were sown at Kolodong and Taree estate, and two of each—owing to want of space—at Dumaresque Island. This plot was fertilised at the rate of a bag of superphosphate to the acre, each section being equally treated.

The Season.

The previous winter had been one of the wettest in the experience of the Manning, culminating in floods in July. Thanks to a fairly dry August, cultural operations were possible, although not as thorough as it might have been had the season been more favourable. The September rainfall, with the exception of a heavy fall in the middle of the month, was light and well distributed. The October rainfall was above the average—one heavy fall helping to "thin" the Kolodong plot, which had been sown a few days previously. November was fairly dry; but December registrations were heavy, and were accompanied by gales from the south. Unfortunately, further damage was done to the Kolodong plot (caught at the tasselling stage) and to the Taree estate plot (where considerable lodging took place). The

Dumaresque Island plot was undamaged. Useful to heavy falls were registered over the maturing months, excepting March and April, which were dry, allowing the crops to ripen off satisfactorily.

The Entries.

The entries totalled nineteen, the number being eight in excess of last season's total. Eleven were from local growers; three from the Rivers north; and the remainder (non-competitive) from the Department, with varieties grown on the experiment farms or from other centres.

Manning Silvermine was entered by Messrs. Dyball, Nixon, Adams, and Everingham—the last two showing a slight trace of impurity, and the maturity being also a little later than the others. Manning White and Hickory King were both good samples. Two good entries were made of Fitzroy, that of Mr. Dorward being slightly deeper grained and rougher in the dent than Mr. Mooney's. The two local entries of Large Red Hogan were carefully selected. Hawkesbury Hogan (maturing very late), Yellow Hogan (seed similar to the winning entry on the Macleay) were both good samples, as also were Golden Beauty and Narrow Red Hogan. Coodra Vale, a variety maturing somewhat earlier than Fitzroy, was uneven, and Pride of Hawkesbury and Golden Drop were both poor, the former having much mould present and its germination being thin throughout, though the resulting crop showed up so promisingly that it is sure to fill a position much higher up the list in future contests.

After-cultivation operations in every instance were conducted in a praiseworthy manner, the owners of the plots having in mind the reputation of their immediate neighbourhood and the district generally.

Harvesting and Yields.

When mature, 3 chains of two rows of each entry on each plot were pulled, husked, bagged, weighed, stored until dry (four to six weeks), then thrashed and weighed. All operations were conducted in the presence of members of the agricultural committee and of the inspector for the district.

Although substantially decreased, the yields at Kolodong were fairly good. The entry of Silvermine (Adam's) stood out prominently with 132 bushels to the acre. The remaining entries were close, ranging between 86 and 104 bushels to the acre. Yellow Hogan, from the Macleay, Levick's and Mooney's Large Red Hogan, and Dyball's Silvermine, being the only other varieties to top the hundred. The tall-growing, later-maturing varieties, such as Hogan's, were badly lodged in this plot, the earlier-maturing lots being practically unharmed. The plot averaged 95 bushels 51 lb. to the acre.

The returns from the Taree Estate plot showed an all-round increase—no less than thirteen out of the nineteen plots exceeding the century. On this farm the three Large Red Hogan varieties topped the list with yields of 131, 128, and 119 bushels to the acre. Dorward's Fitzroy, Booth's Hawkesbury

Hogan, and Everingham's and Nixon's Silvermine also yielded well. Considerable lodging took place here with the same varieties as at Kolodong. The plot averaged 106½ bushels to the acre.

The highest yields were recorded at Dumaresque Island. This was an exceptionally fine plot, the extremely fertile soil, the very favourable conditions, and the application of fertiliser, no doubt, helped to produce such an excellent result. Fourteen entries topped the century mark. Everingham's Silvermine, yielding at the rate of 149 bushels to the acre, Mooney's Large Red Hogan, the same owner's Fitzroy, and Dyball's Silvermine being the best.

The highest average yield fell to Mooney's Large Red Hogan, with nearly 121 bushels to the acre over the three plots, thus winning the competition, and beating last year's winning entry by nearly 7 bushels on the average. Everingham's Manning Silvermine, an entry filling second position last year, occupied the same position this year—a good performance—with 119½ bushels to the acre. A similar distance away was Levick's Large Red Hogan, and then within a few pounds Adam's Silvermine. Last year's winning variety, Fitzroy, filled fifth position, averaging well on all the plots. Both entries from the Macleay behaved admirably. Yellow Hogan, the winning entry in that district's competition, gave an average of 15 bushels more in the Manning competition. Thirteen entries averaged over the 100 bushels.

The districts generally are indebted to the plot-growers, and to the committeemen of the Agricultural Society for giving much time and assistance, and thus making the competition a success.

TABLE OF YIELDS.

Competitor.	Variety	Approximate Maturity Period	Yield per Acre						Average.	
			Kolodong.		Taree Estate		Dumaresque Isld			
		months.	b	lb	b	lb	b	lb	b	lb.
J. P Mooney, Taree	Large Red Hogan	6¼	103	34½	119	18½	139	39¾	120	49½
S. E. Everingham, Moorlands	Manning Silvermine	5	99	12	110	55	149	16	119	27½
G Levick, Taree Estate .	Large Red Hogan	6¾	103	7	131	6½	120	3¾	118	5½
W. J. Adams, Dumaresque Is.	Manning Silvermine	5	132	5½	110	10	121	2¾	117	46
J. P Mooney Taree .. .	Fitzroy . ..	5¼	94	16	107	30½	132	46¾	111	31
J. Booth Kempsey . ..	Hawkesbury Hogan.	6½	92	18	112	25½	124	13¼	109	37½
J. Booth, Kempsey .. .	Yellow Hogan ...	5¾	104	33½	90	38½	119	18½	107	16
R. Dyball jnr., Taree Estate	Manning Silvermine	4¾	101	36½	94	17	127	10½	107	21
Department of Agriculture ..	Large Red Hogan	6¼	88	22	128	37	104	6	107	3
R Richardson, Mondrook ..	Golden Beauty .	5½	92	18	106	31½	122	16½	107	3
D. Dorward, Dumaresque Is.	Fitzroy	5¼	97	13	113	24½	102	49¼	104	29
W. H. Nixon, Glenthorne .	Manning Silvermine.	4¾	87	50½	110	0	109	1	102	8½
Department of Agriculture	Yellow Hogan ..	5¾	87	50½	104	6	113	9	101	36½
J. C Smith, Wauchope .	Coodra Vale	5	90	20	90	47½	117	48	99	38½
Department of Agriculture ...	Pride of Hawkesbury	6	90	47½	98	12	106	31¼	98	29
R. Richardson, Mondrook ...	Giant White ...	4¾	91	19	107	30½	93	44½	97	31½
J. P. Mooney, Taree	Narrow Red Hogan.	5¾	89	48½	101	9	100	37½	97	13
C. Lean, Glenthorne	Hickory King ...	5	89	48½	97	13	95	15	94	8½
Department of Agriculture ...	Golden Drop ..	5¾	86	21	93	17	97	13	92	18

THE MACLEAY COMPETITION.

Although arrangements had been made during the early winter to conduct a competition on the Macleay in conjunction with the local Agricultural Society; the disastrous floods late in July gave the movement such a set-back that it was only by the perseverance of several enthusiastic committeemen, who secured plots and promises of entries, that the movement was launched at all. In many instances farmers who had promised to compete found that their seed maize had vanished in the flood, and others were disheartened with the ruination of their farms by sand and silt, and withdrew.

The Macleay has for many years enjoyed the reputation of being one of the largest maize-producing centres of the State. The returns from the export of maize annually are probably not equalled by any other branch of agriculture. Its lands are expansive and very fertile, areas totalling 40, 50, and 60 acres being sown by a single farmer to maize alone. In such large fields it has been found necessary to deal with the crop expeditiously and as cheaply as possible. Threshing plants driven by tractor power ply round the numerous farms and thresh by contract.

Unfortunately, farmers in their readiness to take advantage of the "plant" while it is available, overlook one all-important point—the next seasons' seed supply. Very rarely is any of the crop saved, nor is even a small area set aside to be sown late for seed. Consequently, the farmer, when planting time arrives, finds himself minus seed, and he has to rely chiefly on the local produce merchants, or perhaps on some unreliable source. It is for this reason, to some extent, that the average acre yield on the Macleay has steadily decreased

For the same reason the number of varieties growing, although few, are represented by numerous types, and each farmer invariably has his own name for his own particular strain. Especially is this so with Yellow Hogan, by far the most widely grown and most popular variety on the River. By means of maize-yielding competitions, it is expected that much of this unsatisfactory state of affairs can be remedied. The heaviest yielding varieties will be discovered, and many of the poorer-yielding types eliminated.

Although only in its first year, the competition has been an undoubted success. Farmers have had the opportunity of witnessing their own varieties in competition with others under similar conditions. In this way much interest has been created, and even at this early stage there has been a keen demand for seed of heavier-yielding varieties.

The Plots.

East Fredrickton (*Mr. D. Dornan*).—This was portion of a paddock that, prior to 1915, had been under pasture for many years; since then maize and field peas have been the main crops grown. The soil was loamy and rich—typical of the best Macleay land, and of many hundreds of acres in the neighbourhood. The July flood left a small deposit of silt. During August, the paddock was deeply disced, ploughed, rolled, and harrowed, and again worked previous to sowing. The plot was in good order; seed hand-dropped on 22nd September, 1921, and covered with single-horse cultivator. Germination was fair to good throughout. The plot was subsequently well cared for.

Gladstone (Mr. H. T. Wheeldon).—This was portion of a paddock adjoining the well-known Austral-Eden Estate, renowned for its fertility. The soil was of a stiff, loamy nature, and had a deposit of silt left on it in July. The paddock was cropped for the first time during 1920; it had previously been fourteen years under pasture. Ploughings were given in March and April, but not again until September, owing to the very wet winter. The seed was hand-dropped on 29th September. Germination was good, although patchy in places. Careful attention was given throughout to the growing crop.

Sherwood (Mr. W. P. Seccomb).—This was portion of a farm in a well-known maize-growing centre on the Upper Macleay. The soil was lighter than down the river. A small flood deposit was left in July. The previous crop was wheat, the paddock had grown maize for many years. It was ploughed during September and October, a good tilth being produced for sowing on 3rd November, 1921. Owing to it being deemed " not strong land," three grains were hand-dropped in the hills instead of four, as on the other plots. The germination was good and the plot was well looked after.

The Season.

Taken all through, the season was not a good one. Too much rain in the late winter months delayed the preparation of the land and the sowings. Cold and wet weather followed in September, and heavy rain in October, falling soon after planting, kept the young growth in check. Maize is a crop that does not require a heavy rainfall during the early stages of growth. Fortunately November was fairly dry, and the crop made good progress. During December, however, further heavy and continuous rains, accompanied by a fortnight of falls from the south, came, and it was this weather that was responsible for a decrease in yield at both East Fredrickton and Gladstone. The latter plot was remarkable for the great number of partially filled cobs present—the result of faulty pollination. January was a better growing month, but February was extremely wet. Fortunately little more damages could be done to the maturing crop. The late-sown crop at Sherwood was only slightly affected, the rain not being as heavy up the river. Suitable weather prevailed over the later months.

The Entries.

Meighell's Martin's Dent was uneven, Booth's and D. Dornan's were good types of Yellow Hogan, while the entries of the other brothers Dornan were slightly uneven. There was a slight difference in the maturing periods of all. Leargent's Little Hogan was also a selection of Yellow Hogan. Meighell's Golden Superb matured a little later than Thurgood's same variety; the latter's seed was the more even sample. Thurgood's Leaming was a fortnight later than Leargent's in maturity. Neither sample was a good type of Leaming, but showed admixture of Golden Superb, and probably also Yellow

Hogan. Brown and O'Shea's Fitzroy, Booth's Hawkesbury Hogan, and Wheeldon's Ribbon Corn were all good. Hawkesbury Hogan proved a tall, rank, late maturing variety. Early Moruya, rather a poor mixed sort, was also late in maturing. Richardson's Golden Beauty was a very attractive sample, and the same farmer's Giant White and J. Ward's same variety were fairly good types. Dyball's Silvermine was fair. Pride of Hawkesbury was poor and mouldy.

At East Fredrickton and Gladstone 4 chains of three rows were harvested, whilst at Sherwood 3 chains were found enough.

The Yields.

At East Fredrickton, including the Golden Superb entries (which were not expected to yield as well as the later-maturing varieties under the conditions), and Silvermine, there was only a difference of 17 bushels between the leading nineteen entries. Booth's Yellow Hogan and Thurgood's Leaming were the only two to top the 80-bushel mark. These were closely followed by Golden Beauty, Pride of Hawkesbury, and D Dornan's Yellow Hogan. The whole plot averaged 70 bushels 21 lb. throughout, which was good considering the unfavourable conditions.

TABLE OF YIELDS.

Competitor.	Variety	Approximate maturity Period	Yield per Acre						Average.	
			East Fredrickton.		Gladstone		Sherwood			
		months	b.	lb.	b	lb.	b	lb.	b	lb.
Department of Agriculture ...	Large Red Hogan	6¼	70	50½	104	51	101	36½	92	28
John Booth, Kempsey ...	Yellow Hogan ..	5¾	83	44½	79	31	110	27½	91	15½
S. E Thurgood, East Fredericton.	Leaming	5¼	83	3	82	48½	87	9	89	1½
R. Richardson, Manning River	Golden Beauty ..	5½	78	25	99	4½	87	19	88	35
Brown and O'Shea, Gladstone	Fitzroy	5½	73	37	99	4	92	18	88	19½
D. Dornan, East Frederickton	Yellow Hogan ...	5¾	75	28	93	30	90	33½	86	30½
Department of Agriculture ...	Fitzroy	5¼	73	6	101	5½	82	5½	85	24½
W. J Leargent, East Frederickton.	Little Hogan ..	5¾	67	22	97	23½	88	22	84	22½
Department of Agriculture ..	Narrow Red Hogan	5½	66	16½	92	45½	85	52½	81	38
Ernest Dornan, East Frederickton.	Yellow Hogan ..	5¾	67	22	89	48½	87	23	81	31½
Department of Agriculture ..	Pride of Hawkesbury.	6	77	29½	85	25	80	30	81	9½
A. Meighell, Billimbopini ...	Martin's Dent ...	5¾	70	19	96	17½	75	7½	80	33½
R. Dyball, Manning River ..	Manning Silvermine.	4¾	54	49	98	39½	85	25	79	38
H. T. Wheeldon, Gladstone ..	Ribbon Corn ...	5¼	67	43	92	24½	76	34	78	52½
R Richardson, Manning River	Giant White ...	4¾	71	22	82	48½	79	31	78	52½
Brown and O'Shea, Gladstone	Early Moruya ...	5¾	67	1½	87	36½	79	3½	77	51
J G. Ward, Sherwood ...	Giant White ..	5	69	13½	76	54½	84	26	76	50
Adie Dornan, East Frederickton	Yellow Hogan ...	5¾	69	54½	94	36½	63	47	76	8½
W. J. Leargent, East Frederickton.	Leaming... ...	5½	68	7½	79	10½	73	9½	73	28
J. Booth, Kempsey	Hawkesbury Hogan.	6¼	73	26½	60	43½	81	1½	71	43½
S. E. Thurgood, East Frederickton.	Golden Superb ...	4½	53	2	96	48½	78	4½	71	18½
A. Meighell, Billimbopini ..	Golden Superb ...	4½	62	13½	72	42½	78	32	71	10½

At Gladstone heavier yields were recorded, the Department's Large Red Hogan and Fitzroy topping the 100-bushel mark. There were also ten other entries in the nineties, showing the evenness of the plot. Richardson's

Golden Beauty, Thurgood's Leaming, and D Dornan's Yellow Hogan held their places well, while Booth's Yellow Hogan fell off somewhat. The whole plot averaged 89 bushels 6 lb. to the acre—the highest of the series—a very fine average considering the buffeting the crops received in December.

At Sherwood there was considerable shuffling in the positions, Booth's Yellow Hogan returning the fine yield of 110 bushels to the acre—the highest in the plots, and placing it ahead of the local entries in the aggregate. The Department's Large Red Hogan came next with 101 bushels, and was the only other one to top the hundred mark. The three high plot yields of this variety placed it at the head of the competition (non-competitively). Most of the remaining yields were in the eighties, Thurgood's Leaming and Richardson's Golden Beauty yielding sufficiently well to gain third and fourth positions in the aggregate. The plot did not yield as evenly as the others, and filled second place, averaging 84 bushels 5 lb. per acre

While the yields do not compare favourably with those of the Manning competition, in fairness to the Macleay farmers it must be stated that they had all the worst of the conditions, and a late start to contend with. The success of the competition was due to the manner in which these plot growers cared for the plots throughout, and to those committeemen who were only too willing to give their services when required.

Yearly Prices for Wheat.

The Department is indebted to Mr. H. A. Smith, Government Statistician, for the opportunity of quoting the following from the "Official Year Book of New South Wales" recently published:—

The following table gives the average prices per bushel ruling in each year since 1898. . . . .

The prices quoted are for an imperial bushel of 60 lb. in Sydney markets.

Year.	February.		March.		Average Value for Year		Year	February		March		Average Value for Year	
	per bushel.		per bushel.		per bushel.			per bushel.		per bushel.		per bushel.	
	s.	d	s.	d.	s.	d.		s.	d.	s.	d.	s.	d.
1898	4	0	4	0	3	8	1911	3	7¾	3	5	3	6
1899	2	7½	2	9	2	9	1912	3	9¼	3	8½	4	1
1900	2	9	2	8	2	8½	1913	3	6½	3	7	3	2¼
1901	2	7	2	7	2	8	1914	3	8	3	9¼	4	1½
1902	3	2	3	2¾	4	5	1915†	5	6	5	6	5	5
1903	5	11⅝*	5	9¼*	5	1¾*	1916†	5	1¾	5	0¼	4	10
1904	3	0½	3	0¾	3	2	1917‡	4	9	4	9	4	9
1905	3	4½	3	3⅜	3	5	1918‡	4	9	4	9	4	9
1906	3	1⅝	3	2¼	3	3½	1919‡	5	0	5	0	5	1½
1907	3	0⅞	3	1½	3	10	1920‡	8	5*	8	10*	8	7¼
1908	4	4	4	5½	4	3½	1921‡	9	0	9	0	8	8
1909	4	0¾	4	6½	4	9	1922‡	5	2	5	11	5	7§
1910	4	1¾	4	1	3	10							

* Imported wheat. † Officially fixed.

‡ Official price on trucks of wheat for home consumption. § To June.

Farmers' Experiment Plots.

MAIZE EXPERIMENTS, 1921–22.

North-western District.

MARK H. REYNOLDS, Inspector of Agriculture.

THE following farmers co-operated with the Department in maize experiments during the season 1921-22 in the north-western district:—

L. P. Dutton, Guyra.
E. Scotton, Uralla.
H. Piper, Llangothlin.
R. Clibborn, Glen Innes.
W. G. Chaffey and Sons, Nemingha.
Faint and Parsons, Kelly's Plains, Armidale
J. T. Cowan, Tenterfield.
H. F. Menzies, Black Mountain.
V. S. Cornish, Red Range, Glen Innes.
W. H. Lye, Loomberah, *viâ* Tamworth.
J. T. Elliott, Armidale.
H. Manser, Tenterfield.
J. S. Whan, Llangothlin.

The tests have demonstrated the suitability for the New England district of certain varieties of maize of an earlier maturing type than has previously been favoured locally. They have demonstrated also the need for fertiliser and a better system of crop rotation, as well as the necessity for making provision for drainage on the level or low-lying lands by a system of narrow lands and trenches. As to rotation, there seems little doubt that the place for maize is following some crop that has added materially to the organic content of the soil, or that, at any rate, has maintained it. If these conditions are recognised, and a suitable fertiliser is sown with the maize crop, there is no reason why profitable yields should not be the general rule in the New England district.

On the upland soils of the Tamworth district, on the other hand, it would seem that the growing of maize for grain may only be justified in general practice as a rotation with small cereals, or as a change and cleaning crop.

Sharp frosts occurred in March throughout New England, causing severe damage in maize crops on level or low-lying situations. The rainfall during the growing period at the experimental centres is shown in the accompanying table:—

RAINFALL RECORDS.

Month.	Guyra.	Glen Innes.	Uralla, Armidale and Kelly's Plains	Tenterfield (H. Manser).	Llangothlin.	Tamworth.
	Points.	Points.	Points.	Points.	Points.	Points.
September	...	404	296	...	...	...
October	486	612	166	48	28 (from 21st.)	...
November	420	277	118	124	226	247
December	968	1,070	720	640	771	685
January	52	173	138	216	75	251
February	403	84	311	57 (to 15th)	138	260
March	149	146	210	...	67	120
April	87	...	90	...	44	...

RESULTS of Variety Trials.

Variety.	Guyra	Guyra.*	Uralla.	Llangothlin (H. Piper).	Glen Innes (R. Clibborn).	Nemingha.	Armidale (Faint & Parsons).	Tenterfield† (J. T. Cowan).	Black Mountain.	Glen Innes‡ (V. S. Cornish).	Tamworth.
	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.	bus.
Minnesota 23	61¼	55	...	31	...	...	...	...	7½	...	...
Sundown	56	51¾	...	30	...	12	...	...	5½	..	...
Golden Glow	51	44½	17⅓	31½	11	...	35	14	12	40	53
Early Morn	52¾	56	...	31½	...	15½	...	...	9	...	43
Wellingrove	33	31¼	22	29	13½	...	31½	13½	6¾	39½	41½
Kennedy	36	...	...	...	...	...	...	...	...	...	...
Gold Coin	...	...	19¾	...	...	...	41½	...	...	...	...
Goldmine	...	...	15½	...	...	...	...	...	..	...	...
American Golden Superb.	...	...	17	...	6½	...	32¾	8	...	35¾	41⅓
Shannon Vale Silvermine.	...	...	19	...	...	...	...	...	...	...	...
Funk's Yellow Dent	...	..	15½	...	6	25¾	34¾	14	..	34½	43
Iowa Silvermine	...	...	17	...	10	25¾	39½	16	...	37½	38
Silver King	...	...	19½	37	...	..	...	...	...	..	.
Leggett's Pride	..	...	...	...	...	24½	...	...	...	...	36½
Golden Superb	...	..	...	...	9	...	42	19	...	31½	43
Ninety Day	...	...	...	...	...	...	31	...	...	...	...
Eureka	..	.	..	...	...	...	35	14½	...	.	40
Early Clarence	...	...	...	...	...	...	...	...	..	...	46½
Golden Nugget	...	..	...	..	..	...	...	...	...	..	46½
Local Early Leaming.	..	...	...	...	...	...	...	...	...	..	43

*1 cwt proprietary fertiliser applied per acre. †60 lb. superphosphate applied per acre.
‡1 cwt proprietary maize fertiliser applied per acre. The remainder of the plots were unmanured

RESULTS of Manurial Trials.

	Armidale (J. T. Elliott).	Tenterfield (H. Manser).	Llangothlin (J. S. Whan).
Date sown	21st October.	23rd October.	25th October.
Variety	Wellingrove.	Funk's Yellow Dent	Sundown.
	bus.	bus.	bus.
*M 6, 112 lb. per acre	52		
M 6, 100 lb. „	...	37½	......
M 6, 224 lb. „	......	......	21¼
*M 8, 100 lb. „	......	40¼	......
M 8, 126 lb. „	55	......	......
M 8, 252 lb. „	......	......	23
*M 10, 84 lb. „	60	......	......
M 10, 136 lb. „	......	42	......
M 10, 336 lb. „	......	......	23¾
M 10, 168 lb. „	60½	......	......
Unmanured, per acre	48½	32½	21¼
Superphosphate, 56 lb. per acre.	......	39	......
„ 70 lb „	51	......	......
„ 140 lb. „	......	......	22½

* M 6 consists of superphosphate 5 parts, chloride of potash 3 parts; M 8 of superphosphate 5 parts, sulphate of ammonia 4 parts; and M 10 of superphosphate 5 parts, sulphate of ammonia 4 parts, chloride of potash 3 parts.

Details of the Plots.

Guyra.—Land cropped once previously with maize, and, prior to that, used as a sheep camp; hence had been considerably enriched. Soil well cultivated in preparation for the crop, and sown to varieties under test on 21st September in rows 3 ft. 6 in. apart, three grains being dropped every 3 feet. Frost in December checked growth, and severe frosts on 19th, 20th and 21st March killed many plants. Excessive rains in December, followed by dry conditions in January, also affected the yields.

Ualla.—Land cropped for a number of years. Previous crop potatoes (no manure) in 1920. Land well cultivated. Sown 4th November.

Early Morn maize at Llangothlin.

Llangothlin (H. Piper). -Elevation of land approximately the same as that at Guyra, but plots located on steeply-sloping land, and only slightly damaged by heavy December rains. Land cropped for five years. Previous crop, potatoes (no manure). Well cultivated, and sown 30th October. Unusually early frosts in March affected yields of the later varieties, Wellingrove and Silver King. Guyra rainfall figures may be taken as indicating the precipitation at this centre.

Glen Innes (R Clibborn).—Red loam of basaltic origin. Land previously cropped for some years. Low yields largely to be attributed to the low fertility and want of condition of the soil. Rotation of crops with suitable fertilisers would quickly restore the soil's capacity for profitable production. Seed sown 1st November. Grain of good quality, fully developed, and sufficiently dry to shell and store on 30th May.

Tamworth.—Plots located on uplands on red soil. Previous crop wheat in 1920 (without manure). Maize sown 25th October (with maize dropper), about 2 feet apart, in rows 3 ft. 9 in. apart.

Armidale (Faint and Parsons).—Black loam of basaltic origin. Trials the third crop from pasture. Maize sown 23rd October, following good cultivation. Grain ready to shell on 25th May. In only one variety (Funk's Yellow Dent) was the grain pinched. Grain of this variety, Eureka and Wellingrove were the last to dry out. With the exception of Funk's Yellow Dent, the grain of all varieties was of good quality.

Tenterfield (J. T. Cowan).—Red sandy loam of basaltic origin, cropped for some years. Previous crop oats (unmanured), harvested for hay. Land well cultivated and sown 31st October in moist seed-bed. Early growth promising, but crop soon showed want of vigour. It was apparent that the varieties Eureka, Golden Superb, and Funk's Yellow Dent occupied more fertile and better conditioned soil. The outstanding feature of this trial was the yield of Golden Superb.

Black Mountain.—Previous crop, potatoes (no manure). Sown 19th October. With exception of Minnesota 23 and Sundown, growth and development of grain had not ceased when severe frost, commencing on 19th March, put an end to any further appreciable progress. The plots at this centre are somewhat level, and the soil is inclined (owing to previous cultural methods and cropping) to get quickly out of condition with even the ordinary rainfall. The excessive rains of December, followed by a shortage during the early months of the new year, accentuated this tendency, and it is probable that this was a factor in the low yields.

Glen Innes (V. S. Cornish).—Free-working red loam of basaltic origin. Land well prepared for cropping by being ploughed late in autumn. Previous crop potatoes in 1920–21 (with 3 cwt. superphosphate per acre in furrows). Maize sown 19th October. Good germination and stand. Crop cultivated and kept free from weeds. Glen Innes rainfall may be taken as an indication of the falls at this spot.

Tamworth. -Red loam of shale and limestone formation. Previous crop, broom millet (without manure). Well ploughed and cultivated. Sown 21st November and weed-growth kept in check. Fit to harvest by end of March.

Armidale (J. T. Elliott).- Black basaltic soil Land sloping toward the north: cropped for six years. Previous crop wheat for hay. The early growth on the M6 plot was much slower than that on the others, but eventually caught up.

Tenterfield (H. Manser).—Red sandy soil of granitic origin. Previous crop maize (manured with 1 cwt. superphosphate in drills). Maize dry and fit to pull on 15th April. Apparently no damage was caused by frost during the growing period.

Llangothlin (J. S. Whan).—Red soil of basaltic origin; cropped for six years. Previous crop potatoes (unmanured). Soil somewhat out of condition owing to continuous cropping, and made no better by the excessive rains in December. The results here indicate that for the best results from manuring it is essential that the soil should be in the condition that is brought about by a suitable rotation of crops. The sharp frost in March checked further growth, but good quality grain had matured, and was dry and fit to store by April.

THE COST OF GROWING WHEAT.

THE Department of Agriculture is indebted to Mr. H. A. Smith, Government Statistician, for the opportunity of quoting the following from the "Official Year Book of New South Wales" just published:—

The following estimates have been provided by Mr. A. H. E. McDonald, Chief Inspector of Agriculture, to indicate the average cost of producing wheat on unfallowed and on fallowed land. For the purposes of the estimate the area cropped annually is taken at 250 acres, viz., 230 acres for grain, and 20 acres for hay or horse feed, to crop this area in alternate seasons under the system of fallowing, the total area of the farm would be at least 500 acres. . . . . Experiments made by the Department of Agriculture indicate that an average yield of 20 bushels per acre may be obtained from fallowed land, and the cost of production under the fallowing system is calculated on this basis, while 12 bushels per acre is taken as the yield from unfallowed land; in each case one bushel per acre is deducted for seed wheat, and special allowance is made for seed wheat as an item of cost, since expenses incurred in its production are included under the various headings. . . . .

The costs of production under conditions existing in New South Wales in June, 1922, were estimated as follows:—

Item	Unfallowed Land		Fallowed Land.	
	Per acre,	Total.	Per acre.	Total.
Hypothetical net yield... .. ..bushels	11	2,530	19	4,370
Costs—				
Land—Interest, 250 acres, at £6 per acre, 6 per cent. per annum	£ 90		£ 180	
Plant—Interest and Depreciation, value £680	90		90	
Allowance for Repairs	20		20	
Wages—Extra help	45		45	
Fertiliser—Superphosphate, 6¼ tons	44		44	
Bags—At 10s. per doz.	35		60	
Cartage of Wheat to Rail at 9d. per bag ..	32		55	
Total cost, exclusive of allowance for farmer's labour ... . £	356		494	
	£ s. d.		£ s. d.	
Cost per acre cropped for grain „ „	1 11 0		2 3 0	
„ bushel on rail „ „	0 2 10		0 2 3	
Total cost, including allowance of £260 for farmer's labour ... ... £	616		754	
	£ s. d.		£ s. d.	
Cost per acre cropped „ „	2 13 7		3 5 6	
„ bushel, on rail .. „	0 4 11		0 3 5	

Sizes and Yields of Average Wheat Farms.

Last month a table supplied by the Government Statistician was published in the *Agricultural Gazette,* showing the areas of the holdings on which wheat was grown for grain in the 1920–21 season. The following table, giving the information in a more detailed form, is now made available by the same official:—

Area Harvested for Grain—Series.	Number of Holdings.	Wheat—Grain.		
		Area Cropped.	Production.	
			Total.	Average per acre.
acres.		acres.	bushels.	bushels.
1—29	2,705	37,454	634,176	16·9
30—49	1,166	42,944	746,940	17·4
1—49	3,871	80,398	1,381,116	17·2
50—74	1,261	75,398	1,332,888	17·7
75—99	925	79,175	1,403,598	17·7
100—199	3,771	532,882	9,791,703	18·4
200—299	2,523	597,731	10,742,628	18·0
50—299	8,480	1,285,186	23,270,817	18·1
300—399	1,379	461,854	8,307,552	18·0
400—499	755	328,483	5,773,449	17·6
500—599	427	228,702	4,017,585	17·6
600—699	239	150,601	2,595,285	17·2
700—799	143	104,500	1,871,265	17·9
800—899	97	80,075	1,448,841	18·1
900—999	58	53,494	922,494	17·3
300—999	3,098	1,407,709	24,936,471	17·7
1,000—1,999	171	218,046	3,818,931	17·5
2,000—2,999	22	50,511	968,508	19·2
3,000—3,999	7	23,360	316,752	13·6
4,000—4,999	2	8,392	132,630	15·8
5,000—5,999	1	5,968	83,100	13·9
6,000—6,999	2	13,310	276,960	20·8
7,000—7,999	1	7,124	115,833	16·3
8,000—8,999	2	16,889	189,567	11·2
9,000—9,999	.....	......	......	......
10,000—10,999	1	10,484	134,673	12·8
2,000—10,999	38	136,038	2,218,023	16·3
Total, New South Wales	15,658	3,127,377	55,625,358	17·8

Total number of holdings on which wheat was sown, 17,790.

Total area sown with wheat, 3,663,352 acres.

Field Experiments with Maize.

GRAFTON EXPERIMENT FARM, 1921–22

A. W. S. MOODIE, Experimentalist.

THREE experiments with maize, comprising investigations as to the residual effect of fertiliser on the crop, and ploughing, cultivation, and de-suckering trials were carried out at Grafton Experiment Farm during the season 1921-22. The variety used in these experiments was Leaming. The rainfall for the season was as follows:—

1921.	Points.	1922.	Points.
July	1,063	January ...	22
August ...	41	February ...	982
September ...	486	March	83
October ...	229	April	...
November ...	135	May	154
December ...	689	June	291
Total ...	41·75 inches.		

The heavy flood rains of July, 1921, following on those of May, made it impossible to carry out any early preparation of the soil, which remained unfit for working, except in a few instances, until the beginning of September. Portions of the area were then found to be in a very poor condition, making the working of the soil a very difficult matter in the time available. The hollows, having been for so long under water, were in a particularly bad condition for working, and as they ran across the plots, yields were lowered to some extent. Although the rainfall for the growing period was good in the aggregate, it was inclined to be erratic, January especially being a bad month for the November-sown crop.

All the experiments were situated on black alluvial soil fairly typical of the maize-growing areas of the Clarence River district. The low yields obtained may be attributed to the lateness of the preparation of the ground after being in such a sodden condition, and the low January rainfall. Those portions of the crop growing in the low-lying areas yielded practically nothing, although the soil appeared to be in a good state of tilth. Except where otherwise stated, ploughing was carried out with the double-furrow disc plough to a depth of 8 inches.

It is unfortunate that the results of last year's experiments were lost because of the floods. With the results of those experiments included, some fairly definite information, based on results extending over three years, would have now been available.

Residual Effect of Fertiliser Experiments.

This experiment, the object of which was to determine the residual effect of superphosphate upon the yields of subsequent crops, consisted of four plots (each measuring approximately one-sixth of an acre), Nos. 1 and 4 receiving no manure, No. 2 receiving 2 cwt. of superphosphate each year, and No. 3, 2 cwt. of superphosphate during the first year only. The fertiliser was applied to the last-mentioned plot in November, 1919, so that the crop now under discussion is the third grown without any further application.

The land utilised for this experiment has one very deep hollow running across it, and this portion became waterlogged, delaying ploughing for some time. The area was ploughed on 13th October and immediately harrowed down. On 3rd November it was disc-harrowed, ploughed again on 18th November to check a self-sown crop growing from seed left unharvested because of the floods, and harrowed down ready for planting on 22nd November Planting was done with a maize-dropper, with mouldboard attachment. in rows 4 feet apart, three grains being sown every 32 inches. The superphosphate in plot 2 was sown at the same time through the manure-box.

Germination was excellent, a good stand being obtained. The crop was cultivated with the single-horse implement on 21st December and hilled with the disc hiller on 4th January. Two more cultivations were given to destroy weeds and conserve moisture, and the crop always presented a clean appearance. The rainfall over the growing period was as follows:—22nd to 30th November, 39 points; December, 689; January, 22; February, 982; March, 83. Total, 18·15 inches.

Harvesting was carried out on 9th May, the three inside rows of each plot of five rows being pulled, with the following results:—

Treatment.	Yield per acre.		Increase due to treatment.		Value of Increase.			Cost of Increase.			Net Gain.		
	bus.	lb.	bus.	lb.	£	s.	d.	£	s.	d.	£	s.	d.
2 cwt. superphosphate each year	49	23	8	30	1	16	3	0	14	0	1	2	3
2 cwt. superphosphate first year only	45	2	4	9	0	17	8	......			0	17	8
No manure	40	49	. ..		......			.....			......		

These figures were arrived at on the following basis :—Maize calculated at 5s. 3d. per bushel, less 1s. for marketing charges, equal to a net return of 4s. 3d. per bushel; superphosphate 7s. per cwt.

Time of Ploughing Trials.

This experiment was carried out on an area consisting of three plots (each measuring approximately one-fifth of an acre), Nos. 1 and 3 receiving a winter ploughing, and No. 2 being ploughed in spring. Both ploughings were somewhat delayed owing to the flood rains, but the ground on which the experiment was conducted being some of the highest on the experimental area, it dried more quickly than other portions, and plots 1 and 3 were ploughed on 16th August.

During the fallow the plots were harrowed on two occasions after falls of rain, and the surface was kept as loose and free from weeds as possible. They were again ploughed on 12th October, this time in company with plot 2. The three plots were then disc-harrowed and cross disc-harrowed, and on 18th November they were spring-toothed and cross-harrowed with the light harrows ready for planting, the extra treatment received by the winter-ploughed plots thus consisting of one ploughing and two harrowings.

Ploughing was in each instance carried out with the single-furrow mouldboard plough to a depth of 8 inches. Plots 1 and 3 were undoubtedly in better condition than plot 2 at time of planting, which was carried out on 21st November with the maize-dropper with mouldboard attachment, rows 4 feet apart, three grains every 32 inches. The germination was excellent. All the plots were cultivated on 20th December and hilled on 4th January. They subsequently received two more cultivations with the single-horse implement and were kept free from weed growth.

The rainfall figures for the growing period are the same as in the previous experiments.

Harvesting was carried out on 10th May, with the following results:—

Treatment.	Yield per acre.	Increase due to treatment	Value of Increase	Cost of Increase	Net Gain.
	bus. lb.	bus. lb.	£ s. d.	£ s. d.	£ s. d.
Winter ploughed	55 2	18 43	3 19 9	1 4 0	2 15 9
Spring ploughed	36 15	.. ...	...	.... .	......

These figures are arrived at on the following basis:—Ploughing with single-furrow mouldboard, £1 per acre; harrowing, 2s. per acre; value of maize, 4s. 3d. per bushel.

The result of this year's experiment shows very clearly the value of an early preparation of the land for maize, especially in a season when the rainfall fails at a critical stage in the growth of the crop, the earlier and consequently better prepared land being able to withstand the dry spell and keep the crop in good condition.

Lateness of Cultivation Experiment.

The object of this experiment was to compare the yields of maize cultivated up to tasselling with the yield from maize which had been given only one cultivation after hilling. The area was ploughed on 12th October and immediately harrowed down, and subsequently disc-harrowed and cross-disced. On 18th November the spring-tooth cultivator was used, followed by use of the light harrow working in the opposite direction preparatory to sowing on 21st November, when the soil was in a good state of tilth. Planting was done with the maize-dropper, with mouldboard attachment, in rows 4 feet apart, three grains being dropped every 32 inches.

Germination was excellent. The three plots (each measuring approximately one-fifth of an acre) were cultivated on 20th December with the single-horse implement and hilled on 4th January with the disc-hiller. The three plots were then cultivated thoroughly to clean out the middles. Up to this stage the plots received exactly the same treatment, but from this point plot No. 2 received no further cultivations, while plots 1 and 3 were each cultivated twice more up to tasselling. These plots (Nos. 1 and 3) presented a much cleaner appearance during the later stages of growth than No. 2.

The rainfall figures for the growing period are the same as in the previous experiment. Harvesting was carried out on 9th May, the three inside rows of each 5-row plot being pulled as before, with the following results:—

Treatment.	Yield per acre.	Increase due to treatment.	Value of Increase.	Cost of Increase.	Net Gain.
	bus. lb.	bus. lb.	£ s. d.	£ s. d.	£ s. d.
Cultivated to tasselling .	44 38	6 27	1 7 6	0 13 0	0 14 6
One cultivation only after hilling	38 11	...	..	.. ...	...

These figures are arrived at on the basis of—maize 4s. 3d. per bushel; cultivation, 6s. 6d. per acre.

De-suckering Trials.

In estimating the value of de-suckering it is necessary to compare the worth of any increased yield attending the treatment with the cost of the extra labour involved, taking into consideration also the value of the suckers removed and utilised as green fodder.

The land used for this experiment (comprising two plots, each measuring approximtely one-third of an acre) was ploughed on 27th September and harrowed down. It was then disced and cross-disced and just before planting cross-harrowed, the result being a fairly good state of tilth. In order to obtain as much suckering as possible and illustrate the effect of de-suckering the more graphically, this experiment was sown during October (26th). The method of planting was also altered with the same object, single grains being dropped every 12 inches instead of three grains every 32 inches. Instead of sowing in furrows, the dropper was used without the mouldboard attachment, the grains thus being dropped closer to the surface and suckering thereby encouraged. The rows were 4 feet apart.

Germination was satisfactory. Cultivation (with the single-horse cultivator) was commenced on 18th November. Hilling was carried out early in December and the crop was again cultivated on 23rd December. Throughout its growth the soil was well stirred and the area kept free from weeds. De-suckering was carried out on 11th January, and as the crop had suckered freely the operation took considerable time.

The rainfall over the growing period was as follows:—November, 135 points; December, 689; January, 22; February, 982; March, 82; total, 19·11 inches. Harvesting was carried out on 5th and 6th April, five rows being harvested from each of the two 10-row plots. The crop had suffered severely from weevil infestation and from attack by birds (principally crows and rosellas). The results were as follows:—

Treatment.	Yield per acre.	Increase due to treatment.	Value of Increase.	Cost of Increase.	Net Loss.
	bus. lb.		£ s. d.	£ s. d.	£ s. d.
De-suckered	41 34	+ 1 ton 2 cwt. 3 qrs. 26 lb. green fodder. - 6 bushels 23 lb. grain *	+ 0 17 2 - 1 7 3*	0 17 6	1 7 7
Untreated	48 1	....	......	.....	....

* Decrease

Maize was reckoned at 4s. 3d. per bushel, and green fodder at 15s. per ton. Cost of labour in de-suckering was reckoned at the rate of approximately 10 hours (at 1s. 9d. per hour) per acre, one man taking three hours to de-sucker the experimental plot of one-third of an acre.

Hilling v. Flat Cultivation

Flat cultivation is practised by many farmers, some hilling with the plough, and others with the disc hiller. This experiment was designed to afford data regarding the different methods of cultivation.

The land was ploughed 8 inches deep and harrowed on 29th September, disc-harrowed, then cross disc-harrowed, spring-tooth cultivated on 15th November, and lightly harrowed at right angles to the planting. Planting was effected with the maize dropper with mouldboard attachment on 19th November, the rows being 4 feet apart, three grains every 32 inches. The germination was excellent.

Cultivation was commenced on 19th December with the single-horse cultivator, all plots being then cultivated alike. On 5th January No. 2 plot was hilled with the mouldboard plough, and No. 3 with the disc-hiller, Nos. 1 and 4 being left "flat." The weed-growth in the rows was well smothered by both implements, but fewer roots were damaged by the hiller than by the plough.

Harvesting was carried out on 11th May, the three inside rows of each plot of five rows being pulled. The hilled plots presented the cleanest appearance at this date. Results:—

Treatment.	Yield per acre	Decrease due to treatment.	Value of Decrease.	Cost of Treatment	Net Loss.
	bus. lb.	bus. lb.	s. d.	s. d.	£ s. d.
Flat cultivation	45 37	....	......	......	....
Hilled with disc-hiller	45 31	0 6	0 5	5 2	0 5 7
Hilled with plough	41 28	4 9	17 8	7 6	1 5 2

These figures were arrived at on the following basis:—Disc-hilling, 5s. 2d. per acre; hilling with plough, 7s. 6d. per acre; maize, 4s. 3d. per bushel.

Western Wheat-growing Competitions.

AN ANALYSIS OF THE SCALES OF POINTS.

H. BARTLETT, Inspector of Agriculture.

IN designing the schedule under which points are awarded in the growing crop, fallow, and fallow-and-crop competitions, which many agricultural associations in the western district are now organising, the aim has been to make it as educative as possible, giving each of the factors in good returns its exact relative importance, so that when the judging is over the competitor may quickly grasp the reasons for his success or failure. An analysis of these factors which will inform judges what they must consider when allotting points in each section, and indicate to competitors by what methods they may increase their scores, may be of interest, for a clear understanding of the various headings should increase the usefulness of the contests.

Growing Crop Competitions.

The following is the scale of points adopted for the growing crop competitions:—

	Points.
Trueness to type	20
Freedom from disease	20
Evenness	20
Cleanliness (1st crop, 24 points; 2nd, 25; 3rd, 26; 4th, 27; 5th, 28; 6th, 29; over 6th crop, 30).	30
Condition and appearance (1st crop, 24 points; 2nd, 25; 3rd, 26; 4th, 27; over 4th crop, 28)	28
Apparent yield (1 point for each bushel)	32*
Total	150

*Approximate.

Trueness to Type.—Under this heading the judge will consider—(1) correctness of type—a crop may be of one type, but, owing to faulty selection, it may differ from the recognised true type; (2) extent of reversion or "running out"; (3) proportion of natural crossbreds; and (4) proportion of "strangers" present, late strangers mixed with an early crop being particularly objectionable.

In order to lose as few points as possible on the score of (1), (2), and (3), the competitor should either follow a system of seed selection or purchase a small quantity of selected seed from the Department with which to establish a stud seed plot, or for the same purpose a larger quantity from a grower recommended in the Department's monthly "pure seed" list. As to (4) the competitor should hand-pick the crop, sow seed wheat only upon fallowed land, and sow and harvest with clean machines.

Freedom from Disease.—The points to be kept in mind by the judge under this heading are absence or presence of (1) smut; (2) take-all; (3) foot-rot; (4) flag smut; (5) rust; and (6) mildew.

To guard against smut the competitor must pickle the seed with a suitable fungicide, and use only new or pickled bags for seed so treated; the seed saved must be from crops free from smut, and the grain-box of the drill must be washed with a formalin solution. To minimise loss of points in relation with (2), (3), and (4), he must burn all infected stubbles, fallow correctly, and practise rotation of crops—merely leaving the paddock out to grass is of little value. Avoidance of sowing rust-liable varieties in heavy low-lying land will go far to guarantee safety in connection with (5), while (6) (mildew), which as a rule only occurs in rank crops when conditions are moist during August and September, may be controlled by feeding-off the crop before a rank state is attained.

Evenness.—In allotting points for evenness the judge should consider uniformity of height, density, and stooling of the crop.

The characters constituting evenness depend in the first place upon thoroughness of ploughing and cultivation, attained by adjustment of the implements to suit variations in soil texture, the even depth and straight drilling of the seed, the use of graded seed, and if necessary the feeding-off, rolling, or harrowing of the crop. Where variations of soil types cause a slight unevenness, points are not lost, unless two crops are equal in all other respects.

Cleanliness.—Presence in the crop and along the headlands of black oats, barley grass, wild lettuce, saucy jack, thistles, &c., should be looked for by the judge when awarding points under this heading. Useful grasses and herbage, which are of value when grazing stubbles, should not cause loss of points unless so thick as to constitute a menace to the wheat crop.

Thorough cultivation of the fallows and their feeding-off with sheep, the use only of graded seed, rotation of crops to include a grazing and silage crop, and hand-pulling of weeds where they are few, will go a considerable way to protect the competitor from loss of points. Barley grass may probably be a greater pest than black oats, as it is a host of foot-rot and probably of take-all. A range of points from 24 to 30 is necessary in this section, as only careful farmers will produce clean crops after the sixth time of cropping. If a paddock has not been cropped for five successive seasons the crop will be considered as a first.

Condition and Appearance.—The judge will take into account (1) the extent of lodging, and (2) the prospect of the crop maturing plump grain and producing the estimated yield, consideration being given to possible frosting, wilting (burning off), and depreciation due to weeds and disease.

The competitor should safeguard his crop from lodging and frosting by sowing suitable varieties at the correct time, and by feeding-off forward crops. The most serious loss of points in this section will be caused by wilting (owing to lack of moisture) and possibly disease. Wilting seldom occurs with a clean crop grown on well-worked fallow, and the amount of wilting is often dependent upon the prevalence of weed growth, which latter may also cause pinched grain. Most diseases become prominent as the crop reaches maturity; but many crops have to be judged when the grain is in the milk stage, when there are indications that disease might influence the yields. In allotting points in the sections comprising freedom from disease, cleanliness, and estimated yield, the judge cannot take deductions of points on a basis of mere possibility, and it is for this reason, and so that the judge may value the crop more accurately, that the section relating to condition and appearance has been included. In the absence of sound farming methods, weeds and disease will increase with each year of cropping, each year making crops of good condition and appearance more difficult to obtain. Hence a range of points from 24 to 28.

Estimated Yield.—The yield is estimated on the assumption that the season continues to be normal. Abnormal conditions are provided for under the preceding section.

If the fallow has been well worked, if the moisture-content of the soil is high, and if a good season is anticipated, an increase in the amount of graded seed sown per acre may prove profitable.

Particulars required by the Judge.—Each competitor in a crop competition should supply, at time of inspection, the following information to the judge:—

1. The previous cropping of the paddock.
2. The date and nature of the ploughing and subsequent cultivations of the fallow.
3. If possible, the monthly rainfall from date of ploughing.
4. Sowing particulars, names of varieties, whether the seed was graded or not, the method of pickling, the amount of seed sown per acre, the amount of fertiliser applied per acre, the date of sowing, and the machine used.
5. Such other details as may be required.

The most suitable time for judging a growing crop competition is November.

Fallowing Competitions.

The following are the points suggested for fallowing competitions:—

	Points.
Moisture	30
Mulch	30
Freedom from weeds	30
Consolidation	30
Cultivation	30
Total	150

Moisture.—Points allotted in this section should be based upon the amount of moisture present in the first 2 feet of soil.

In order that he may obtain as many points as possible under this heading, the competitor should plough the fallow early to a suitable depth, cultivate prior to harvest, and work the fallow during the summer so as to maintain a loose, friable surface free from weeds. Maintenance of the humus content of the soil has, of course, an important relationship to the maintenance of soil moisture. In the event of scattered storms favouring some fallows just prior to judging, suitable adjustments will be made.

Mulch.—An effective mulch consists of a layer of loose, friable soil, composed of small clods and fine soil particles, distributed evenly over the whole of the fallow to a depth of 2½ inches.

To obtain such a mulch the competitor must make judicious use of the many cultivating implements, bearing in mind that the disc cultivator produces a fine surface and is heavy of draught, the spring-tooth cultivator will bring clods to the surface and is of medium draught, and the harrow will break a crusted surface and is light of draught. All summer cultivations should be shallow.

Freedom from Weeds.—In this connection the duty of the judge is obviously to take note of the proportion of weeds present. Especially should he look out for paddy-melons, stink grass, and thistles.

In order that he should not lose points by reason of weed infestation, the competitor should make use of the harrow shortly after the germination of such weed seeds as are present, and of the harrow or spring-tooth cultivator (or of the disc-cultivator, if neither of the implements mentioned proves effective) at a later stage. A cultivation which is otherwise unnecessary may often be deferred if the weed growth (which term includes grass) is grazed with sheep.

Consolidation.—By consolidation is meant the degree of compactness of the soil immediately below the mulch. The soil at this point should be firm, though not as solid as that below the ploughing depth. The competitor can only bring about the desirable condition upon well-worked fallowed land. Contributing factors are the weight of teams and implements, which compact the sub-surface soil a little more with each cultivation, the action of implements such as the harrow in allowing fine particles of soil to run to the point of the teeth, and the action of water, which in percolating through the soil packs the fine soil particles more closely together. It must be noted that a deep cultivation prior to sowing has a detrimental effect on such consolidation.

Cultivation.—In allotting points under this heading the judge must take into consideration the thoroughness and evenness of the ploughing and subsequent cultivations, paying special attention to uniformity of depth in the mulch and compactness of the sub-surface soil, which latter must also be of suitable depth. The condition of headlands and diagonals (where cultivations have not been in "lands") must be noted too, as well as the economical use or waste of land alongside fences. Whether the fallow has been worked judiciously (in relation to the use of implements and the number of times worked) must also be considered, taking into consideration the type of soil, tendency to weed growth, and climatic conditions.

To obtain maximum points under this heading, the competitor must adjust his implements to suit variations in the texture of the soil. Straight work will mean nothing missed.

Particulars required by Judge.—Each competitor in a fallow competition should at time of inspection supply the following information to the judge :—

1. The previous cropping of the paddock.
2. The date and nature of the ploughing and the subsequent cultivations.
3. If possible, the monthly rainfall from date of ploughing.

The most suitable time for judging a fallow competition is March to April.

Fallow-and-Crop Competitions.

A fallow-and-crop competition extends over a period of two years, the awards then being given to the competitors whose fallow and the crop grown upon that fallow aggregate the highest number of points. If, in the case of a competitor who has competed just previously in a growing-crop competition, the estimated yield of that crop has exceeded 32 bushels, making the possible points of that competition more than 150, the additional points should be credited to him in the fallow-and-crop competition. The total points possible in a fallow-and-crop competition will be 300 or more, according to whether the estimated yield of the crop exceeds 32 bushels per acre.

THE SUCKING SHEEP LOUSE (*Hæmatopinus ovillus*), IN AUSTRALIA.

THE common biting louse of sheep (*Trichodectes sphærocephalus*) is the wool louse introduced in Australia some years ago, which has become a serious pest over a large area. I have now to record the presence of the sucking sheep louse (*Hæmatopinus ovillus*) in our western flocks in badly infested wool received from the Chief Inspector of Stock.

Two species of sucking lice (*Hæmatopinus ovillus* and *H. pedalis*, the latter infesting the legs of sheep), are known in New Zealand. It is stated that, though the sucking lice mat the wool together with countless millions of eggs (nits) and lice in all stages of development, usually on the under-surface of the body, they do not set up the intense irritation that is caused through the presence of the biting louse.—W. W. FROGGATT, Government Entomologist.

Staggers or Shivers in Live Stock.

[Continued from page 659.]

SYDNEY DODD, D.V.Sc., F.R.C.V.S., Lecturer in Veterinary Pathology and Bacteriology, University of Sydney, and MAX HENRY B.V.Sc., M.R.C.V.S., Government Veterinary Surgeon, New South Wales.

Experiment No. 2.—*To ascertain whether feeding with mallow* (Mallow parviflora) *would produce Staggers.*

A.—In December, 1912, four sheep were each fed with 1 lb. of mallow seeds, with negative results.

B.—In February, 1920, three sheep were fed for sixteen days on mallow. After the third day 40 lb. were fed daily. The results were negative. This experiment was conducted at the University with mallow cut some days previously several hundred miles away. It was therefore very dried up on receipt, as well as being old in growth, having more stalks than leaves. In this case also the test by driving the animals for a distance may not have been continued long enough on each occasion that the test was made. Consequently, in the light of later knowledge, one must view this experiment as inconclusive.

C.—In September, 1920, four ewes with lambs were fed for seven days on a total of 44 lb. of mallow. Result, negative.

D.—In September, 1920, six ewes with lambs were fed on fresh mallow growing in a district where staggers had not been known to occur; 9 lb. per head were fed daily. These animals were tested at intervals for the occurrence of staggers by driving but without result until 5th October, when, after thirty minutes' driving, the lambs showed typical symptoms of the disease. These symptoms disappeared after twenty minutes' rest, but reappeared after a short drive. On the following day the animals were driven, with the same results. On account of the great distress shown by the lambs it was decided to discontinue driving them. The ewes were tested by driving at intervals until 27th October, but at no period was any sign of staggers observed in them. In connection with this experiment, it may be well to observe that sheep normally feeding in the area where the work was done obtain other feed besides mallow; indeed mallow forms a very small portion of their diet.

E.—In the same locality as the above (a staggers-free area) six sheep 5 months old were penned on 6th December, 1920, and fed on 72 lb. dry mallow daily. Nothing abnormal was observed, although the animals were tested by driving twice, until 15th December (ninth day), when on driving all the sheep walked with a staggering, stilty gait. Their respiration was very rapid, and finally all the sheep dropped and trembled violently. The distance the sheep were driven on this occasion was not recorded. The feeding was continued, and on 29th December they were driven half a mile. One sheep was very weak and unable to travel fast, but no symptoms of staggers were observed in any of them. On 30th December (twenty-fourth day) five of the sheep were driven (the weak animal being left in the pen).

After travelling a mile one sheep fell over and trembled violently; it died within two minutes with evidence of respiratory failure, the body at times being convulsed in the attempt to inspire. Prior to the collapse there was no suggestion of the animal being affected during the drive. The remaining sheep were driven, in all, about 3 miles, but no symptoms of staggers were noted.

Experiment No. 3.—*To ascertain whether cut mallow, fed to sheep on affected country, would produce Staggers.*

Two wire-netted pens, each sufficiently large to hold four ewes with lambs, and separated only by a wire-netting fence, were constructed alongside the paddock in which the previously mentioned grazing experiment (Experiment No. 1, page 657) was conducted. All the vegetation was removed from these pens and the top layer of soil was removed. Four ewes, each with a lamb, were conveyed to each pen by lorry from a staggers-free area.

The sheep in No. 1 pen were fed entirely on cut mallow of 2 to 12 inches or more in height. This was obtained partly from a paddock situated on rising ground a few miles away and partly from an alluvial paddock. The mallow was cut with a sickle, and great care was taken to exclude any food other than mallow. After the first driving test an occasional blade of grass or of herbage may have been included, but 99 per cent. of the feed was mallow only. No rust (*Puccinia malvaccarum*) was seen on the mallow during the first fourteen days' feeding, but subsequently this rust, which is exceedingly prevalent on mallow, began to appear. The amount of mallow eaten by the sheep (four ewes and four lambs) averaged about 26 lb. daily for twenty-nine days, the smallest daily amount consumed being 6 lb., and the greatest 43 lb. The mallow was eaten readily by three of the ewes, but the fourth animal was some days before she would do more than nibble at it. The lambs also nibbled small quantities of the plant.

The sheep placed in No. 2 pen were fed on lucerne hay, with an occasional feed of cut green lucerne. The sheep in both pens were supplied with rain water for drinking purposes in tin buckets.

Both pens were occupied by the sheep on 11th August, 1920. On 16th August (fifth day) both lots (which showed no difference in condition) were driven independently for thirty-five minutes at a fast pace, care being taken that the sheep did not eat anything during the drive. After the mallow-fed sheep had been driven about twenty minutes signs of distress such as have been recorded in the general experiments began to appear in the lambs. This distress increased, and immediately after being returned to the pen one lamb was seized with a characteristic spasm and, with two others, lay down in an exhausted condition. The fourth lamb, which showed least distress, was rather poor and weak and belonged to the ewe that did not eat the mallow readily. None of the ewes were effected during this test.

The ewes and lambs from No. 2 pen (lucerne fed) travelled faster than those from No. 1, but went strongly, and the lambs finished the journey playing and skipping. No signs of staggers were seen, nor did the animals even lie down when returned to the pen.

On 17th August, both lots of sheep were again driven for about 2 miles. Only stray portions of plants were cropped during the journey. The ewe from No. 1 pen, which had eaten little of the mallow, and was poor and weak, had to be left behind half-way together with its lamb, and they were picked up on the return. It was considered that this inability to travel was due to weakness. The animals were travelled at a fast pace for sheep. The three remaining mallow-fed lambs which performed the whole journey, collapsed on return, and showed characteristic spasms of staggers. The one which was left behind with its mother completed the return journey without trouble. The three mallow-fed ewes were quite normal on return to the pen.

None of the lucerne-fed ewes or lambs exhibited any abnormality during or after the journey, save that one lamb appeared rather exhausted, the day being warm and sunny.

On 28th August (seventeenth day) all the animals were again driven, this time for about 4 miles (in the interval between the second and third tests two of the mallow-fed lambs died). For the first 2 miles all the lambs travelled well, but shortly afterwards the two remaining mallow-fed lambs developed staggers, and had to be carried. The lucerne-fed lambs, and all the ewes, remained normal. The weather was warm and sultry, and there was practically no difference in the condition of the mallow-fed and lucerne-fed animals.

On 14th September (thirty-fourth day), the animals were driven a fourth time, about 4 miles in one hour fifty minutes. The weather was cool and cloudy. After going three-quarters of a mile, both mallow-fed lambs collapsed with staggers; the lucerne-fed lambs and the ewes remained unaffected. On this day, these sheep and lambs, together with another lot of sheep (sheep A.2.) were turned into the general paddock used for the previously recorded grazing experiment (Experiment No. 1, page 657). This paddock had now become covered with a luxuriant vegetation which contained mallow, but not in great proportion.

On 20th September (fortieth day), all the ewes and lambs were driven more than 3 miles, and the only animal to show any signs of staggers was a lamb from the pen in which lucerne had formerly been the sole feed.

Remarks.—Lambs which were suckling ewes furnishing an ample supply of milk, and which were fed on a diet of mallow, in addition to milk, on ground where the disease had occurred naturally, and had previously experimentally been produced by grazing at large, developed staggers in four days, whereas those fed on lucerne on ground immediately adjoining the affected animals, remained normal. Adult sheep in the same pens, whether fed on mallow or lucerne, remained staggers-free. The possibility of other plants being implicated was removed by the fact that all other herbage in the enclosures was carefully pulled up by hand, and nothing was allowed to grow therein. The removal of the top layer of soil disposed of the possibility that seeds of other plants lying on the ground may have had some influence in producing the disease. That the condition was produced solely in the mallow-fed lambs and not in those fed on lucerne indicates that the disease was not transmitted in any other way than by ingestion, as the pens were adjoining and completely open to the air. The provision of a special water supply showed that the causal agent was not in the drinking water. This is confirmed by the lambs in the grazing experiment, which had no water during the experiment.

Although in both this and the grazing experiment the ewes ate a large amount of mallow, no staggers developed in them up to the time of discontinuing the particular experiment, yet it developed fairly early in the lambs, which were from 1 to 4 weeks old. Now lambs of that age do not ingest a large amount of solid food daily, their main diet being their mother's milk. The first inference from this is that lambs are much more susceptible to the "toxin" in mallow than are adults; the second is that in all probability the toxin is conveyed in the mother's milk to the lamb. Furthermore, from these experiments it would appear that if mallow actually be the cause or one of the causes of staggers, either a more prolonged diet of mallow is necessary to produce symptoms in adult sheep, or else the plant in its early stages of growth, as fed on the foregoing occasions, is not so toxic for adults. Other aspects of the question were also suggested by the experiments, but they will subsequently be dealt with.

It will be noted that on being turned into the open paddock in which the two pens were situated, only one lamb (and that lamb the one previously fed on lucerne only) subsequently showed anything remotely suggesting staggers. The suggested explanation is that owing to the abundant growth of herbage of various kinds on this latter occasion (it was standing knee-deep), the amount of mallow ingested by the sheep was insufficient to produce any clinical symptoms in the animals—even the lambs, save the one mentioned which may have been unduly susceptible to small amounts of the poison. On the previous occasions where the animals were grazing at will (Experiment No. 1), the only plant at the time with any pronounced growth was mallow.

Experiment No. 4.—*Feeding in a staggers-free area (at the University) with cut mallow from a staggers district.*

Two ewes, each with a month-old lamb, and two hoggets were fed with cut mallow *ad libitum*, and no other food was given. Feeding was commenced on 21st September, 1921, and ceased on 3rd November, 1921, a period of six weeks. During this period the animals consumed a total quantity of 1,192 lb. The material, which arrived at regular intervals, had been cut about twenty-four hours, but by the time each consignment had been consumed, it had wilted. At the beginning of the experiment, the mallow was young, and had not commenced to flower; later on, it was in full flower, and at the end had attained full growth and was seeding freely. All the animals ate the mallow freely, the young lambs, of course, only nibbling small amounts.

The first test by driving was made on 28th September (seventh day), when all the animals were driven at a fast pace for an hour. All were exhausted at the finish, but there was no evidence of staggers. They were again tested on 5th October (fifteenth day), with negative results. The test was again carried out on several occasions with the same result, until on the 15th October (twenty-four days from the commencement of feeding), when the animals were driven for an hour at about 4 miles per hour (an abnormal pace for driving sheep), one lamb showed some stiffness in the fore limbs after about twenty minutes driving. Almost immediately afterwards it stopped, and commenced to shiver, pronounced fibrillar contractions of the superficial muscles of the whole body, including the tail, being evident. The animal only stopped for a few seconds and then ran about 100 yards to catch its dam. It again stopped for a few seconds showing the same symptoms, and then ran on again, but this time for only about 50 yards. Again it stopped and trembled violently, and this time the spasms appeared more like rigors. It made another attempt to keep up with the others, but ran only for about 20 yards, when it trembled, lay down, got up again, ran a few yards, trembled, lay down, and then refused to move. The respirations were abnormally rapid, but as this may have been due to the rapid pace at which the animals were travelling it cannot be taken into account. There was no temperature. The flaccidity of the muscles in general was marked.

After about half an hour's driving the second lamb showed exactly the same train of symptoms as the first. It is interesting to note that there were no signs of systemic trouble. Both the lambs commenced to eat the grass around them quite soon after they had lain down. Symptoms soon disappeared after resting, only to reappear again in a more intense form after the animals had travelled a short distance. The stiffness in gait was a preliminary symptom in both lambs.

The four adults were driven at a fast pace for an hour, but showed no sign of staggers, though they were exhausted at the end.

On 26th October (thirty-fifth day), all the animals were driven for an hour at a fast pace. One lamb developed most pronounced symptoms of staggers within fifteen minutes of starting. The second lamb showed symptoms half an hour from the start of the drive, but much slighter than the first animal. In both cases the symptoms were not quite the same as seen in the first instance. There was no distinct quivering of the skin, nor was there any pronounced stiffness of the fore limbs. On the other hand the rigidity of the hind quarters and of the tail was very marked. The pupils were dilated, but the sensory functions did not seem to be interfered with, and the various reflexes were present. The first lamb could only travel about 20 yards after resting, but the second could run quite 50 yards before stopping, and then dropping to the ground.

On 3rd November (forty-third day), the animals were again tested by driving; after three-quarters of an hour the first lamb showed signs of staggers, *i.e.*, fibrillar contractions of the superficial muscles, but these soon passed off on resting. The attack was not severe. The second lamb developed an attack after travelling an hour, and in this case also the symptoms were much slighter than they had been on previous occasions.

The experiment was discontinued on this date. None of the adult sheep had shown any signs of staggers during the whole period of feeding, although the driving tests were severe. In a few days the two affected lambs had quite recovered, and driving did not elicit anything abnormal.

Remarks.—The point to be noted in this experiment is the length of time that elapsed between the beginning of feeding mallow and the appearance of symptoms of staggers, viz., twenty-four days. In the previous experiments, carried out on the spot where the plant was growing and therefore fed fresh, symptoms appeared in four days. In the experiment conducted at the University, the animals were not tested by driving every day, consequently they may have been clinically affected a day or so before the symptoms were actually observed.

The usual symptoms of the complaint were observed, but again, only lambs were affected, the adults remaining quite normal, although the tests applied were severe. The symptoms rapidly disappeared after the cessation of feeding, indicating that no structural alterations had been occasioned, the recovery being complete.

(*To be continued.*)

"Cyclopedia of Farm Crops."

"It is not sufficient, in these days, merely to know the kinds of plants and how to grow them. The reader should have a background of other plant knowledge, as a part of his agricultural education." Thus does Mr. L. H. Bailey, author of these 699 pages of excellently printed and illustrated matter, preface "A popular survey of Crops and Crop-making Methods in the United States and Canada."

This cyclopedia aims at providing the background of knowledge in a most handy and accessible form, describing first the structure and physiology of plants and their response to artificial stimulus. The insect pests and diseases that attack plants, the modifications that can be obtained in the hands of the plant-breeder, crop and farm management, seeding, planting and yields, and such general subjects occupy over 100 pages, and the manufacture of certain crop products (such as canning, preserving, drying, pickling, brewing, &c.) occupy another 30 pages.

From these preliminaries one turns to the bulk of this fine volume, which comprises an encyclopædic reference to seemingly every field crop grown in North America—beginning with alfalfa (lucerne), and ending with wheat, but touching in the journey from the beginning to the end of the alphabet probably nearly a hundred different crops. Barley, for instance, upon which we may happen to open, is discussed in relation to its botanical characters, the area devoted to it, its practical varieties, its culture, diseases, uses, and by-products, and is illustrated by eight cuts and one full-page process block It is characteristic of the States that the article on maize occupies nearly thirty pages.

A good deal of space might be devoted to an analysis of this volume, which is one of a series edited by Mr. Bailey, but enough has been said to indicate its scope.

Our copy is from the publishers, The Macmillan & Company, Ltd., New York.

Fodder Crops for Dairy Farmers.

Northern Tablelands.

MARK H. REYNOLDS, Inspector of Agriculture.

THE district dealt with hereunder constitutes that country north of Murrurundi, with an elevation of from 2,000 to 4,500 feet, and includes Uralla, Armidale, Guyra, Ben Lomond, Guy Fawkes, Glen Innes, Tenterfield, and portion of the Inverell district It comprises the Liverpool Range generally and the spurs within this zone. In this extensive belt a greater range of crops may be grown than on the lands of Central or Southern Tablelands.

At elevations of 4,000 feet or over- the elevation of the country from Black Mountain to Ben Lomond exceeds this figure—grasses, herbage, and fodder crops are generally dormant from June to September, and growth is very slow in May and October; hence fodder crops intended for winter feed should have attained practically full growth by the end of May. The growing period at an elevation of 2,000 feet in the same latitude, however, is generally some two and a half months longer, and crops may be sown six weeks earlier in the spring and four weeks later in the autumn. Farmers should keep a record of temperatures, and especially of the date of the first frost in the autumn and the last in the spring, though a temperature just about freezing point seldom causes much damage unless it is a sudden drop from mild weather. The longer the growing season, of course, the greater the production possible, other things being equal. The greater portion of the arable land in the district under discussion consists of good fertile soil, but there are sections of poor quality, and on these portions rotation must be practised and suitable fertilisers used if satisfactory yields are to be obtained.

In the warmer parts of the Northern Tablelands there are districts such as Inverell and Tenterfield. Tenterfield has an elevation of 1,000 feet more than Inverell, but being situated some 50 miles north of it, enjoys spring conditions only about a week later. The natural grasses and herbage here are somewhat dry from December to March, and in such parts spring-sown fodder crops are essential. In the more elevated parts there is generally available good, succulent natural herbage and grass throughout spring, summer, and autumn (that is, for seven months of the year), and it is for the remaining five months (late autumn, winter, and early spring) that feed must be provided.

Root crops, such as swede turnips (both for culinary and stock-feeding purposes), and white and yellow turnips rarely fail on the Northern Tablelands, and yields of 20 tons per acre are not uncommon. If these crops are sown in February and March, they are ready to feed late in the winter and in the spring; they are suitable for the feeding of all stock, especially cattle, sheep, and pigs. Crops such as cabbage, rape, and mustard (also excellent food for stock) thrive in this zone; while a wide range of leguminous crops, such as culinary peas and beans, field peas, tick and broad beans, Lima beans, vetches, clovers, and lucerne may all be cultivated with success.

Wheat, oats, barley, and rye also produce well, and good yields of grain, hay, straw or green fodder (as the case may be) are obtainable; the Department makes special recommendations of wheat and oat varieties, according to whether they are for spring or autumn sowing. Maize (for grain, green fodder, or stover) can be grown over the whole area, suitable varieties producing yields of 30 bushels and upwards per acre, and sorghums (especially Saccaline and Amber Cane) yield well. Spring-sown Sudan grass produces two cuts of fodder, each about 4 feet high.

For purposes of green fodder and silage, sunflowers have also given good results, producing greater yields of green fodder than maize, while the silage has proved a relishable and good milk-producing ration for dairy cattle.

SOWING Table of Fodder Crops, Northern Tablelands.

Crop	When to Sow	How to Sow.	Quantity of Seed per acre	Available for Grazing.	Available for Cutting
Wheat, Oats, Barley, and Rye	Feb to Oct	In drills, 7in apart .. Broadcast	40 to 60lb. 50 to 80lb	Any time ...	When in flower
Maize	Sept to Jan	In drills, 2ft 6in to 3ft apart Broadcast ..	30 to 20lb 60 lb	Any time ..	When in tassel and cob.
Sorghum ...	Sept. to Jan	In drills, 2ft 6in. to 3ft 6in apart Broadcast	8 to 6lb 14lb	When seed is formed *	When seed is formed.*
Sudan Grass ..	Sept to Jan	In drills, 7in to 2ft 6in. apart Broadcast ..	14 to 4lb 14lb	With care, any time.	When in flower.
Lucerne ..	March to May, and Aug	In drills, 7in apart .. ... Broadcast ...	8lb 12lb	Any time ...	When one-third of the crop is in flower.
Clover	Feb to April, and Aug	In drills, 7in apart .. Broadcast ..	6lb 10 lb.	Any time ...	When one-third of the crop is in flower.
Grasses ...	Feb to April, July and Aug	In drills, 7in to 3ft, apart .. Broadcast ..	15 to 3lb. 20 lb	Any time ...	When in flower.
Turnips (Swedes)	Feb. to April	In drills, 2ft to 3ft apart .. Broadcast ..	4 to 3lb. 10lb	Any time ...	When in flower.
Rape ...	Feb to July	In drills, 7in. to 3ft apart .. Broadcast ..	8 to 2lb. 10lb.	Any time ...	Any time.
Peas and Beans ..	Aug. to Jan ..	In drills, 2ft. 6in to 3 ft apart Broadcast	60 to 50lb. 100lb	When in flower or pod.	When in flower or pod
Artichokes	Sept to Dec	In drills, 2ft. 6in to 3ft. apart ...	2cwt. tubers	......	Dig when tubers are fully developed.
Sunflowers ...	Sept. to Dec.	In drills, 2ft. 6in to 4ft. apart ... Broadcast	6lb. 20lb.	Especially suited for silage.	When well in flower.

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* If sorghum is to be used with safety, it should not be fed until seed has formed. No risk attends the feeding of sorghum if the crop is cut and allowed to wilt for twenty-four hours before being fed.

Three Years' Continuous Herd-testing.

E. H. FILMER, Bimbaya.*

In giving this short summary of three years' continuous herd-testing I am more convinced than ever that the only sure road to success in dairying is a thorough knowledge of the butter-producing capacity of your cows.

By systematic testing, and the culling that must inevitably follow, it is possible to more than double the average yield of, say, three years ago. The benefits of herd-testing were very noticeable during last summer, when the factory turned out 7 tons of butter or over per week, a record that six or seven years ago most of us would have thought impossible. When the manager of the factory and myself went into the matter of herd production, as far as we could gather it stood at about 110 lb. of butter per cow per annum in this district. That was three years ago, and it seems to me that the individual yield has been increased by at least 20 per cent. during this period.

If more systematic feeding and provision for lean times were resorted to it is hard to say where the individual yield would stop. Some New South Wales breeders have passed the 1,000 lb. mark, and we can read where the Yankee has done better still. We have herds on the North Coast which, under official test, have averaged over 320 lb. Better a herd of eighty or ninety cows averaging over 300 lb. than a herd with two or three doing 1,000 lb. and the rest nowhere. The best way, so far as the writer can see, is for the breeder to set himself a standard of say 200 or 225 lb., and when this standard has been passed by judicious culling raise it again to say 250 and higher until the owner is satisfied that he is on the limit.

One thing should be remembered—no amount of feed will make a poor producing cow into a good one. Unless the capacity is there no effort on the part of man can produce it. For these reasons testing and culling should precede any system of heavy artificial feeding for producing high herd records. One very noticeable feature of the records is that cows calving from February to June do not show as good a yield as they have done when calving in August and September. Of course by heavy winter feeding this may be overcome, but the question arises whether it would be wise to regulate matters so that the entire herd was dry in, say, June, July, and part of August. We know this is a debatable question. All the same we admit that it is absolutely necessary for every cow to have at least two months rest between lactation periods. Personally, I think that if the rest were taken by the whole herd at the one time it would bring to many a welcome break in the daily routine of dairy work and would give time to many to effect other necessary improvements.

*Paper read at the June meeting of the Bimbaya branch of the Agricultural Bureau.

After going through my records for three years I find that for 1919-1920 the average was 186 lb. per cow, the highest being 283 lb. and the lowest 62 lb. For 1920-1921 the average was 204 lb. per cow for seventy-two, the highest being 354 lb. and the lowest 90 lb. For 1921-1922 the average was 217 lb. per cow for seventy-seven cows, the highest being 329 lb. and the lowest 135 lb.

For the last twelve months the test sheets show that four cows made over 300 lb. butter each, fourteen made 250 lb. and over, thirty-three made from 200 to 250 lb., twelve made from 180 to 200 lb., eight made from 160 to 180 lb, five made from 140 to 160 lb., and two made 135 and 138 lb. each. Neither of these last completed a lactation period. About twenty-five out of the herd of eighty-four are heifers on the first and second calf, so it will be seen that, in spite of this disadvantage as regards age, by heavy culling the average has increased since 1919-20 from 186 to 217 lb. in 1921-22—an increase per head of 31 lb.

IF IN DOUBT, ASK THE DEPARTMENT.

A FARMER, who had been advised by his neighbours to burn about three tons of hay on account of the presence in it of an allegedly poisonous plant, decided first to obtain the opinion of the Department. Thanks to the information supplied by the veterinary and botanical staffs, he eventually fed the hay to his stock without ill effects. This is an everyday instance of the practical way in which the Department of Agriculture helps the man on the land.

Stockowners may be reminded that, should they at any time be in possession of fodder which they fear may be harmful, the safest and most economical plan is to enlist the services of the Department by forwarding an average sample with full information to the Chief Inspector of Stock, 56 Bridge-street, Sydney.—MAX HENRY, M.R.C.V.S.

"EAT MORE" PROPAGANDA AND THE ORCHARDIST.

THE American farmer is not the only primary producer who is nowadays profiting by the use of advertisement. The English fruit-grower is busying himself with an "eat more" propaganda on a more extensive scale than is perhaps realised by many Australian orchardists. Gooseberries, tomatoes, oranges, and apples are among the products that have been the subject of special advertising drives during the last year or two, and it is claimed by the National Federation of Fruit and Potato Traders' Association that within a week of distributing throughout the country posters picturing the virtues of gooseberries as a food at a time when this fruit was fetching a low figure the price had doubled, while within three days of the issue of a special orange poster setting out the efficacy of orange-juice for combating influenza the price went up from about 13s. to 22s. a case. Last season's Australian apples were "boosted" in England by means of a poster, an attractive coloured sheet measuring about 3 feet by 2 feet, headed "Eat More Apples," and showing a healthy-faced youngster in the act of doing his bit with the consignment.

Farmers' Experiment Plots.

POTATO EXPERIMENTS, 1921–22.

New England District.

MARK H. REYNOLDS, Inspector of Agriculture.

POTATO experiments were conducted in the New England district last season with the co-operation of the undermentioned farmers:—

J. S. Whan, Llangothlin.
J. and A. Piper, Llangothlin
J. W. Jay, Ben Lomond.
R. J. Robinson, Guyra.
O. J. Perry, Dumaresq.
E. Scott, Red Range, Glen Innes
J. W. Webster, Glen Innes.
L. M. Rixon, Uralla.
G. D. Morse, Black Mountain

The season may be described as one of low yields except from elevated or sloping land recently broken from pasture. Excess rains (chiefly in December) caused setting of the soil and waterlogging, and, consequently, rotting of the roots, especially the deep ones. For the first two months of 1922 the rainfall was generally deficient, and the plants, having but few roots and excessive top-growth, suffered proportionately. Early and late blight were in most cases not seriously in evidence (the worst damage was caused at Red Range), but there was a certain amount of leaf roll and wilt, especially in the early-sown crops. The late crops (those planted in December) were generally free from disease, but good yields were prevented by the early frosts from 19th to 21st March.

The whole of the plots were located on red to black soil of basaltic origin. The cultivation of the soil was carried out as uniformly as possible. In most cases the land was ploughed twice, commencing in the early winter; and prior to planting was cultivated either with the spring-tooth or set cultivator or with harrows. The seed (in most cases whole) was planted during process of ploughing, being dropped at distances of about 20 to 22 inches in furrows 30 to 32 inches apart, at the rate of approximately 10 cwt. per acre. The whole of the crops were harrowed, in some instances shortly after planting and thereafter at brief intervals until the crop was about 5 inches above the ground to keep down weed growth. Hilling was carried out on all the plots, and the potatoes were in every case dug by hand.

In this trial Factor, Satisfaction, Early Manistee, Carman No. 1, Up-to-date, Scottish Triumph, and Langworthy matured about the same time, Early Manhattan as a rule a little later, and subsequently Queen of the

Valley, Brownell's Beauty, Coronation, Surprise, and Dakota Red. Factor, it will be seen, yielded highest at eight centres. This variety yielded well in the previous season also. Although a white-skinned potato, Factor is growing in favour because of its good flavour and colour when cooked. Coronation is perhaps the best keeping sort of those on trial. It has a purplish blue skin mottled with white, and is often confused with Manhattan, a variety of the same colour but with the white markings larger and more pronounced. Both are good cookers.

RESULTS of Potato Variety Trials.

Variety.	Llangothlin (J. S. Whan).*	Ben Lomond.*	Guyra. *	Dumaresq. §	Glen Innes (Red Range) ‡	Glen Innes.†	Uralla. *	Black Mountain.*
	Sown 11th Nov.	Sown 1st Nov.	Sown 16th Nov.	Sown 3rd Nov.	Sown 27th Oct.	Sown 9th & 10th Nov.	Sown 3rd & 15th Dec.	Sown 8th Nov.
	t. c. q.	t. c. q.	t. c q	t. c. q.	t. c. q.	t. c q.	t. c. q.	t. c q.
Factor ..	6 16 2	6 5 0	5 10 0	4 19 3	4 0 0	2 18 0	2 12 3	2 17 1
Satisfaction	4 15 1		..	4 15 0	3 11 0	2 15 0	1 13 2	
Early Manistee	4 14 1	4 11 0	..	5 3 2	2 16 0	2 15 3	.	1 17 1
Carman No. 1		.	3 14 0	3 18 2		..	2 9 0	2 16 1
Up-to-date ..		4 14 0	..	.		..	.	.
Early Manhattan	5 7 0	3 16 0	3 18 2		.	1 9 1	2 7 2	1 19 1
Scottish Triumph	4 3 1	4 0 0	.		.	1 3 2	1 3 2	1 14 1
Langworthy		6 0 0		4 0 0	3 2 0	2 18 1	2 1 3	2 8 0
Queen of the Valley	5 11 2	5 2 2	5 6 2		3 6 0	3 2 2	2 11 3	2 7 0
Brownell's Beauty		..	4 8 0	4 10 0	3 8 0	.	..	
Coronation	4 14 1	5 0 0	4 8 0	..	5 14 0	3 3 1		2 14 1
Surprise.	5 4 1	4 10 0	4 14 3	3 11 2	1 10 0	3 13 2	3 14 2	2 0 1
Dakota Red	5 7 0	4 10 0	5 11 0	3 3 2	4 0 0	2 9 3	2 12 1	2 2 1

* Superphosphate applied at the rate of 2 cwt. per acre.

+ Superphosphate appiied at the rate of 3 cwt. per acre.

‡ Superphosphate applied at the rate of 3 cwt. per acre, except on the Brownell's Beauty, Coronation, and Dakota Red plots, to which 4 cwt. was applied.

§ Superphosphate applied at the rate of 3½ cwt. per acre.

RESULTS of Potato Manurial Trials.

	Ben Lomond.	Dumaresq	Guyra.	Llangothlin (J. and A. Piper).		Black Mountain.
	Sown 29th and 30th Oct.	Sown 4th Nov.	Sown 15th and 16th Nov.	Sown 25th and 26th Oct.	Sown 25th and 26th Oct	Sown 15th Nov.
	Coronation	Queen of the Valley	Coronation.	Factor.	Surprise.	Satisfaction.
	t. c. q	t. c. q	t. c. q	t. c. q.	t. c. q.	t c. q.
*P9, 448 lb	9 7 0	6 15 3	4 1 3	3 14 0	3 19 0	2 18 0
P9, 224 lb. ..	7 5 0	6 1 1	3 18 0	3 0 0	3 7 0	.
*P7, 256 lb	6 17 1	6 14 3	4 8 2	2 14 0	3 2 0	1 18
P7, 128 lb. ..	7 1 3	5 0 0	3 6 0	2 8 0	2 16 0	....
*M7, 364 lb. ..	6 19 0	6 17 1	4 3 2	3 6 0	3 2 0	1 0 0
M7, 182 lb. ..	6 5 1	5 12 0	3 0 3	3 1 0	2 18 0	...
Superphosphate, 560 lb.	7 2 3	5 12 3	..	3 2 2	3 0 0	..
Superphosphate, 448 lb.	.	..	2 12 2	...	...	...
Superphosphate, 280 lb.	5 3 3	4 9 2	.	3 4 0	2 16 0	2 1 2
Superphosphate, 140 lb.	6 5 1	.	..	3 5 0	2 18 0	.
No manure..	5 5 1	5 11 0	2 6 2	2 10 0	2 13 0	1 17 1

*The mixture P9 consists of superphosphate 10 parts, chloride of potash 3 parts, sulphate of ammonia 3 parts; P7 of equal parts superphosphate and bonedust; M7 of superphosphate 10 parts, chloride of potash 3 parts.

The results of the manurial trials demonstrate that the highest yields and the greatest return from the use of fertilisers was obtained from the plots comprising land recently broken from pasture, or land which, although it had been under cultivation for some years, had not been cropped with potatoes the previous year. The lowest yields were from somewhat level land where the excessive rains of December caused waterlogging. The plots at Llangothlin and Black Mountain are instances of this. The yields at the first-mentioned centre are comparable, but those at Black Mountain are not, patches being either entirely killed out or very dwarfed and poor-yielding.

It will be seen that with the exception of two plots P9 mixture, applied at the rate of 4 cwt. per acre, gave the highest yields. The approximate cost of the manurial applications in these trials per acre was as follows:—P9 4 cwt., £3 15s.; P9 2 cwt., £1 17s. 6d.; P7 256 lb., £1 7s.; P7 128 lb., 13s. 6d.; M7 364 lb., £2 5s.; M7 182 lb., £1 2s. 6d.; superphosphate 560 lb., £1 17s. 6d.; superphosphate 448 lb., £1 10s.; superphosphate 280 lb., 18s. 9d.; superphosphate 140 lb., 9s. 5d. Estimating the value of table, seed, and small potatoes at £4 per ton on the farm, it will be seen that the heavier applications of P9, P7, and M7 invariably paid, as did also the light dressings of P9 on the four plots on which a fair comparison could be made.

On plots located on old cultivation areas cropped with potatoes for several years without manure, the increase in yield from the application of superphosphate alone is not sufficient to justify the recommendation of such treatment, but where the land is comparatively new to cropping, or its humus content has been maintained by a suitable rotation of crops, superphosphate alone considerably enhanced the yields.

Seed Potato Experiments

The trials included also two experiments with seed potatoes, carried out on Mr. L. M. Rixon's farm.

The yields per acre from single rows of second-growth tubers (sets removed from the parent tuber) as compared with those from "stags" (the parent tuber itself) were as follows:—

	t.	c.	q.
Stags	2	4	2
Second-growth sets	4	2	2

These results show the inadvisability of planting stags—potatoes that have been robbed of their vitality by the formation of second growth.

The yields per acre from single rows of whole seed taken direct from the pit as compared with those from whole seed held in the shed were as follows:—

	t.	c.	q.
Whole seed from pit	4	2	2
Whole seed from shed	4	0	0

The Value of Selection and Breeding.

THE accompanying graph illustrates very clearly the excellent results to be obtained from careful selection and breeding.

The diagram, which has been compiled from the records of the egg-laying competitions at Hawkesbury Agricultural College extending over twenty years, is self-explanatory.

The full black line shows the average in each year of the ten leading pens, totalling sixty birds—not necessarily the best sixty birds, as in the early years of the competition the birds were grouped in pens of six, and it was not possible (as now) to pick out the sixty birds that actually laid best. For the same reason the lighter line shows the average of the lowest pens, but not necessarily of the poorest birds.

The diagram shows up very strikingly the following points:—(1) The greatly increased egg-production of all sections—leading pens, lowest pens, and average for whole competition; (2) the average of the lowest pens is now higher than that of the whole competition in the earlier years; (3) the average for the whole competition is now higher than the average of the leading groups in the early years.

The most pleasing feature of the record is that the improvement, except for seasonal and other explainable causes, has been continuously progressive.

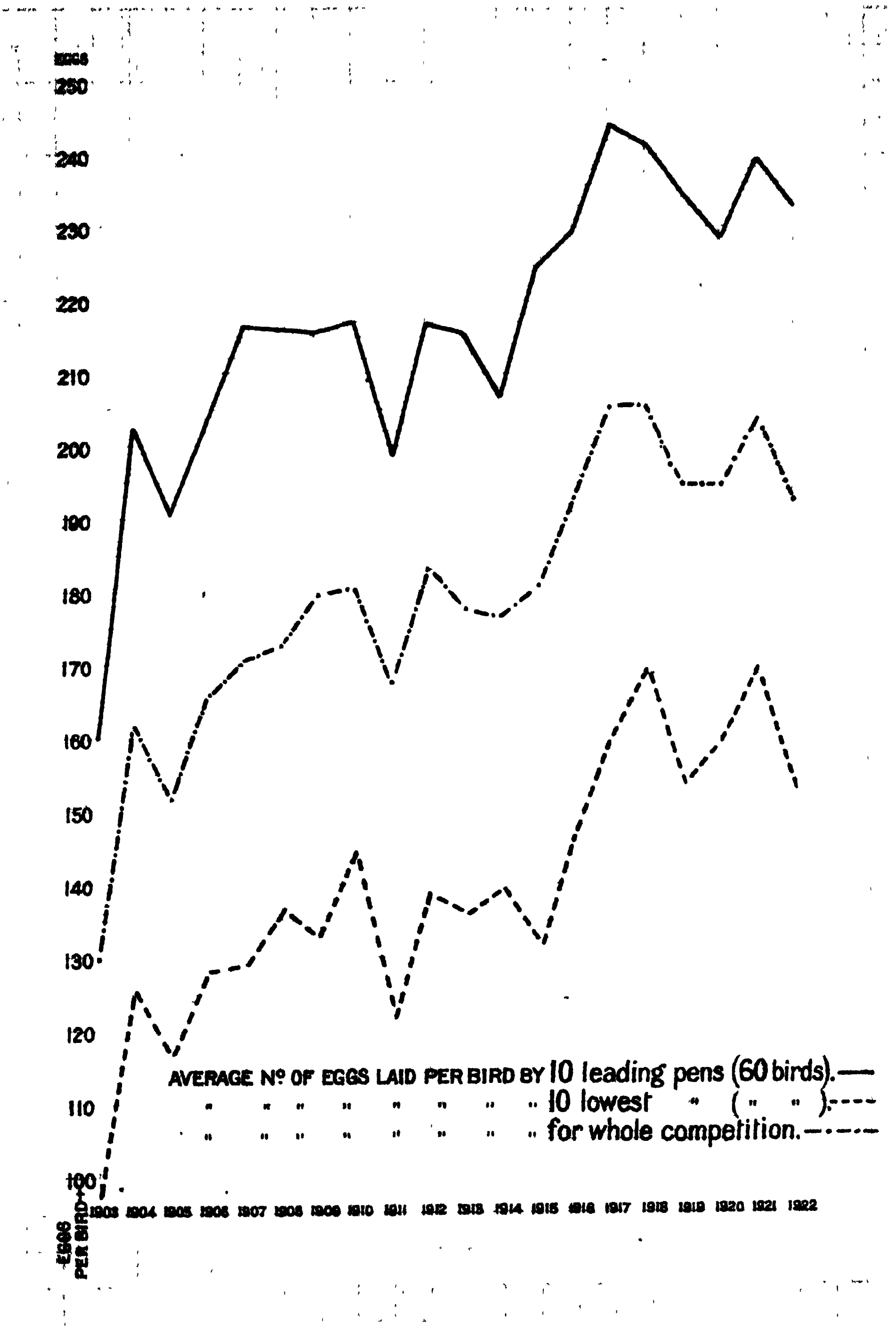
BLADES *versus* MACHINES.

WHETHER blades or machines give the larger clip depends upon the shearer and the type of sheep to be shorn. Some blade-shearers will habitually shear as close as machine-shearers, and from some classes of sheep, say, prime crossbreds. blades will remove quite as much as machines. In general, however, about ½ lb. to 1 lb. more wool per sheep is obtained by the use of machines in the case of grown sheep. In the case of lambs the difference is negligible—perhaps a matter of 2 or 3 ounces.—F. B. HINTON, Sheep and Wool Expert.

ENSILAGE FROM CANE TOPS.

SOME years ago a small silo at this farm was filled with chaffed sugar-cane, with very satisfactory results. It had to be used quicker than ordinary silage, however, owing to the rapid fermentation and decomposition on exposure to the air. With cane tops alone this trouble would not be so great, and properly made silage from tops should prove very satisfactory. Care would have to be taken that the silo was thoroughly packed, and the material evenly trodden down as it was put in.—A. H. HAYWOOD, Manager, Wollongbar Experiment Farm.

Hawkesbury Agricultural College Egg-laying Competition.



GRAPH showing the Value of Selection and Breeding.

The Seed Bean Midge.

(*Camptocladius macleayi* SKUSE.)

T. McCARTHY, Assistant Entomologist.

DURING the latter part of June specimens of germinating bean seed infested with Chironomid larvæ were received from Matcham, with the statement that such larvæ had been responsible for the failure of the early planting of beans in that district. Having had no previous record of such damage by larvæ of this type, and having in mind the general habits of the family to which they belong, it was thought that their presence might have been of secondary significance. A visit to Matcham, however, convinced the writer that such was not the case, and that they had been responsible for considerable damage. Material was collected and transferred to the laboratory, where the adults quickly developed and proved to be a species of the genus *Camptocladius* of the family *Chironomidæ.*

Mr. A. Tonnier, of the Cawthron Institute, New Zealand, to whom the writer is indebted for the determination of the species, has furnished the following notes :—

> The little midge bred from germinating bean seed belongs to the genus *Camptocladius* and corresponds well enough with the description of *C. macleayi*, Skuse, but for the following details :—
>
> Notum not opaque, but more or less shining; halteres in female completely dirty yellow ; proportions of the four sections of the costa different, chiefly in female.
>
> On the other hand, the prepared male forceps is similar to the one of *C. nudipennis*, described in 1913 by Dr. Goetghebuer*, to which it corresponds in other characters, so far as can be ascertained here, where the original description is not now available.
>
> The species submitted might, therefore, be an introduced insect from Europe described by Skuse under the name of *C macleayi* and later on by Goetghebuer as *C. nudipennis.* The European forms of this genus have been very badly known until recently, and the latter author has described about ten new species, some of which are very common.
>
> The only way to be sure of the identity of the species with *C. macleayi* would be to prepare the hypopygium of Skuse's type and see whether it corresponds with that of the species submitted, of which a sketch is appended. Then, to ascertain its identity with the European species, specimens should be sent to Dr. Goetghebuer, 41 rue Neuve, St. Jaques, Gand, Belgium.
>
> This species is also very common in New Zealand, and the larva has been recently found in damp earth mixed with tea-leaves. So far as is known, the larvæ of *Camptocladius* are either aquatic or else live in a rather wet medium, as they have to breathe through their skin, not being provided with spiracles. It is, therefore, probable that the seed from which they have been obtained was unusually wet, or already attacked by some other pest, or else mixed with damp earth.

A technical description of this species can be found in the "Proceedings of the Linnean Society of New South Wales," Second Series, Vol. 4, 1889, p. 266.

Character of the Injury.

The maggots entered the seed as soon as the seed-coat burst and appeared to concentrate on the young shoot, tearing the primary leaves with their saw-like jaws; and aided by the decay that followed, the whole shoot was

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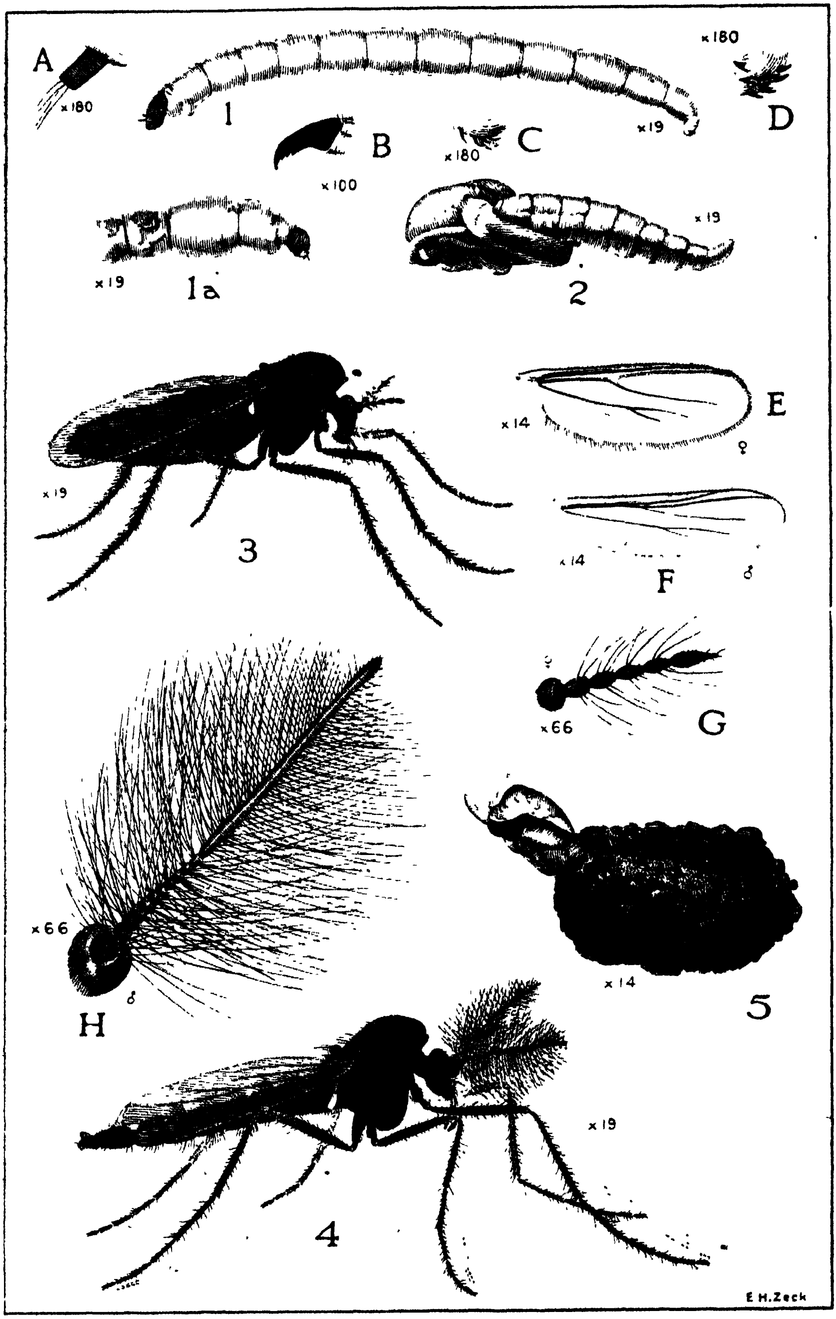
* *Ann. biol. lac.*, p. 19; figured again in *Mem. Mus. hist. nat. Belg.*, viii, fas. 4, p. 87.



The Seed Bean Midge (*Camptocladius macleayi* Skuse).

1.—Larva. 2.—Pupa. 3.—Adult female. 4.—Adult male. 5.—Pupal cell, showing discarded pupal skin. A.—Antenna of larva. B.—Mandible of larva. C.—Hooks on thoracic process. D.—Hooks on anal process. E.—Wing of female. F.—Wing of male. G.—Antenna of female. H.—Antenna of male.

destroyed often before the young plant had appeared above the ground. In some cases the young shoot was not wholly destroyed, and the young plants had appeared above ground and were apparently overcoming the attack, although their progress had been much retarded. None of the plants had escaped damage to some extent, while the percentage of plants totally destroyed was high, and numerous gaps and imperfect plants could be noticed all along the rows, necessitating the re-planting of the whole area.

The origin of the attack is unknown. The majority of Chironomid larvæ are aquatic, but some live in the earth, manure, or under bark. It seems likely in this instance that the maggots were already in the soil feeding on decaying vegetable matter before the beans were planted, and were afterwards attracted to the seeds as soon as germination commenced. Maggots were found free in soil where beans had been planted and not actually infested.

Description of Stages.

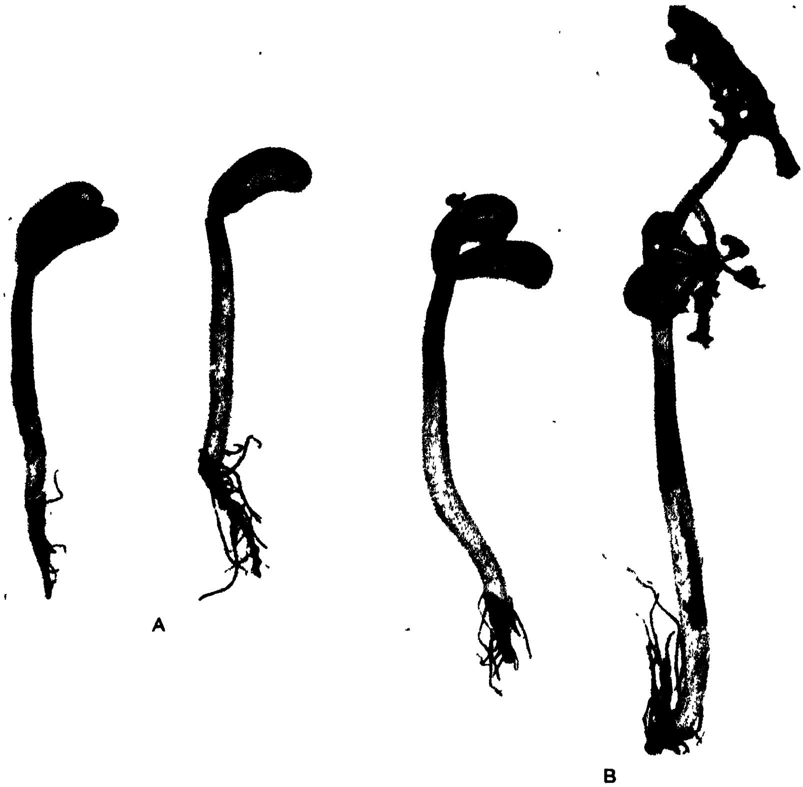
Larva.—The larva is about one-fifth of an inch in length, shining white and slightly opaline in colour, distinctly segmented and tapering towards the extremities so that the anterior abdominal segments are longest and have the greatest diameter. The thoracic segments are equal. The first thoracic segment and the anal segment are provided with fleshy processes or rudimentary prolegs, that on the prothoracic segment being armed with a row of hooks at the apex behind which are twelve irregular rows of minute setæ, and that on the anal segment with twenty-seven hooks in two irregular rows. The head is yellowish-brown, longer than broad, with a pair of prominent rudimentary eyes or pigment spots (sometimes wanting), ... and antennæ, the latter consisting of one basal joint and two more slender terminal joints. The mandibles and labium are black, the former being 4-toothed and the latter 11-toothed, the central tooth being very large and rounded.

The larva is extremely delicate, and dies quickly when exposed. In movement it somewhat resembles a minute looper caterpillar, but there is no regular humping of the body, and the looping movement is irregular to one side or the other. It pupates in the soil in a loosely-constructed earthen cell of sand grains, held together with a few silken strands and a thin coating of a slime-like substance on the inside.

Pupa.— The pupa is elongate, about one-tenth of an inch in length, with the thorax enlarged and the outline of the future perfect insect distinct. The head, thorax, and wing-pads are nearly black, and the abdomen yellowish-white and thickly covered on the dorsal surface with minute spines. When mature the pupa works its way out of the earthen cell and leaves the discarded pupal case projecting.

Adult.—In general form the adults resemble mosquitoes, but are much smaller in size. The male is about one-tenth of an inch in length, and differs from the female in being longer and more slender and in having antennæ, which are fourteen-jointed, and densely covered with long dark brown hair. The ground colour of the insect is black, but in a large series of specimens examined the presence of a bloom, more pronounced on the abdomen, gives it a dark bluish-grey appearance. The abdomen is clothed with long dark brown hair, and the thorax with two longitudinal rows of short dark brown hairs. The palpi, antennæ, and legs are dark straw colour, the legs being covered with spine-like hairs, which are shorter and finer on the front pair.

At the time of writing the adults can frequently be seen on the windows in the house, and large numbers have also been observed in the orchard resting on the foliage of citrus trees. Like the mosquitoes, midges are often seen dancing in the air in swarms, usually towards evening.



Bean Seedlings damaged by the Seed Bean Midge.

A.—Seedlings totally destroyed by the midge. B.—Seedlings that have made an effort to recover from the injury done.

Economic Importance.

Excepting the members of the genus *Ceratopogon*, which have the power of sucking blood, the members of the family *Chironomidæ* have been regarded as inoffensive, or actually as beneficial as scavengers. Consequently they have not attracted the attention of workers in economic entomology, and I can find but few references to the larvæ being destructive. Edith M. Patch refers in 1913 to a Chironomid larva in the role of a potato miner, but in 1917 states that "no similar occurrence has come to the writer's attention, and it is hoped that the attack was due to some peculiar local-condition which may not again prove favourable to the midge in its career as a serious pest of potatoes."

The infestation in beans now under discussion is the first record in New South Wales so far as the writer is aware of damage by midge larvæ, and his observations suggest that it is largely, if not wholly, influenced by too early planting. The main early sowing in the district occurs about the middle of July, but some growers, anxious to take advantage of the high prices of a very early market, planted about a month earlier. It being midwinter, the germination of the seed and the growth of the young plants were extremely slow, and the maggots (attracted apparently by the natural fermentation of the seed) were able in many cases to destroy the plant totally even before it appeared above the ground.

It would appear therefore from the circumstances surrounding the present attack, and the absence of previous records of similar damage by Chironomid larvæ, that their occurrence as injurious insects is entirely dependent upon some peculiar local condition.

Control.

The primary cause of this attack seems to have been the planting of the seed when the conditions were unfavourable to rapid germination and growth. No advantage can be gained by planting seed when conditions favourable to germination are absent, as the seed remains dormant or even decays in the soil. Rapid germination and growth will enable the plant to resist or overcome damage by the maggots. Very early plantings should therefore be made only when the conditions may be expected to favour fairly rapid germination and growth. A dressing of lime worked into the surface of the soil before planting the seeds will destroy a number of these delicate maggots.

SCHOOL IN APICULTURE AT HAWKESBURY AGRICULTURAL COLLEGE.

EARLY this year the Department conducted a successful school in apiculture at Hawkesbury Agricultural College. The Minister, the Hon. F. A. Chaffey, has now decided to hold another school at the College early next year, from the 3rd to 20th January.

A fee of £4 will be charged to cover board and lodging, medical fees, and tuition, and arrangements are being made with the railway authorities for a concession on railway fares on the return journey from Richmond.

Persons who desire to attend should communicate as soon as possible with the Under Secretary, Department of Agriculture, Sydney, who will be pleased to supply copies of the prospectus and further particulars.

SOME EXPERIMENTS IN DRYING APRICOTS.

A SERIES of experiments designed to compare the efficacy of different methods of drying apricots was carried out at Yanco Experiment Farm last season. In every case the fruit was dried on trays and placed under the drying racks; this meaning that it was dried in the semi-shade and probably took a couple of days longer than it would have done had it been dried out in the open. Each sample was sulphured overnight and put out on 31st December, 1921. The different treatments employed and the results are shown in the following table:—

No. of Experiment.	Treatment Employed.	Results and Remarks.
1.	56 lb. of fruit was dipped in caustic soda solution (1 lb. to 30 gallons of water) for 10 seconds. Sixty per cent. were dry on 6th January and the remainder the following day.	The 56lb. dried out to 13 lb., equal to 1 lb. dried fruit to 4⅓ lb. fresh. A very nice bright colour.
2.	56 lb. of fruit was dipped in caustic soda solution (1 lb. to 30 gallons of water) for 5 seconds. Fifty per cent. were dry on 6th January and the remainder the following day.	Dried out to 12½ lb., equal to 1 lb. dried fruit to 4½ lb. fresh. Dull and unattractive.
3.	56 lb. of fruit was dipped in caustic soda solution (2 lb. to 30 gallons of water) for 8 seconds. Sixty per cent. were dry on 6th January and the remainder the following day.	Dried out to 12½ lb., equal to 1 lb dried fruit to 4½ lb. fresh. A little on the dark side.
4.	56 lb. of fruit was dipped in caustic soda solution (2 lb. to 30 gallons of water) for 5 seconds. Sixty per cent. were dry on 6th January and the remainder on the following day.	Dried out to 12½ lb., equal to 1 lb. dried fruit to 4½ lb. fresh. Not quite so bright as No. 9, but a good colour.
5.	56 lb. of fruit was dipped in caustic soda solution (2 lb. to 30 gallons of water) for 3 seconds. Forty-five per cent. were dry on 6th January and the remainder on 7th and 8th.	Dried out to 12½ lb., equal to 1 lb. dried fruit to 4½ lb. fresh. A good colour, but not as bright as No. 9.
6.	Fruit sprinkled with water before being sulphured and *not* dipped in caustic soda solution. Twenty per cent. were dry on 6th January, the remainder not complete until 11th January.	Dull and unattractive.
7.	Fruit dried whole (*not* dipped in caustic soda solution) and dry sulphured. The drying period in this experiment was the same as in No. 6.	Bright, but stones showing through the flesh.
8.	Fruit dried whole, with seed removed; *not* dipped in caustic soda solution. Twenty-five per cent. were dry on 6th January, and the remainder on 9th January.	A nice sample, but a little dark.
9.	Fruit dried whole, with seed removed. Dipped in caustic soda solution (2 lb. to 30 gallons of water) for 3 seconds. Forty-five per cent. were dry on 6th January, and the remainder on 8th January.	A nice sample, bright in colour.

—W. J. ALLEN and J. M. ARTHUR.

A Kit of Carpenter's Tools.

WITH SPECIAL REFERENCE TO PLANES AND SAWS.

[Continued from page 669.]

M. H. ROBERTSON, Instructor in Carpentry, Hawkesbury Agricultural College.

The Use of the Planes.

THE correct handling of tools is one important factor in obtaining success with them. In using the planes, the correct position in which to stand at the bench is with the feet about 2 feet 6 inches apart, the left foot parallel with the bench and the right foot at right angle to the bench. This position gives a firm foothold. The two large planes are held alike. The handle is gripped with the right hand and the front top of the plane with the left hand, the elbow pointing directly ahead (see Figs. 15 and 16).

In the case of the smoother, which has no handle, grip the back of the plane with the right hand, at the same time holding the wedge and iron with the thumb and first finger, and with the left hand grip the front of the plane (see Fig. 17). The German jack is gripped at the back with the right hand, just as in the use of the smoother, and the left hand takes hold of the horn in front (see Fig. 18).

A brief description of how to square a rough piece of sawn timber may be of interest, as the initial part of any job. It is necessary first to know what amount of reduction is required. If the rough timber is only to be reduced one eighth of an inch, for instance, the whole of that reduction must not be taken off the first side, or the discovery will be made that the other side has yet to be planed off and that there is no margin on which to do it without spoiling the job. The first thing to do is to get one side absolutely true. This involves getting the timber true as to length and breadth, and also as to anything in the nature of a twist. It might be thought that provided timber is true as to length and breadth it is absolutely true, but not necessarily so. There may be a twist (or "wind") in it, and this must be carefully worked out in getting the first side true.

The German jack will be used to take the rough or "dirt" off, the jack will partly straighten the piece of timber, and the trying-plane should make it perfectly true.

To ensure that it is free from a twist, two "winding sticks" are required. These are two pieces of timber, each 12 inches long by 2½ or 3 inches wide and ½ to ¾ inch thick. They are bevelled on one edge, and one has this straight edge painted white while the other has the straight edge painted black (see Fig. 19). To test a piece of timber, the two sticks are placed on the timber and sighted to see that they are perfectly level. In the case of a long piece of timber the winding sticks should be tried in several places to make sure that the face is perfectly level and uniform. If the winding sticks discover a twist it must be planed out before the other sides of the timber are attempted.

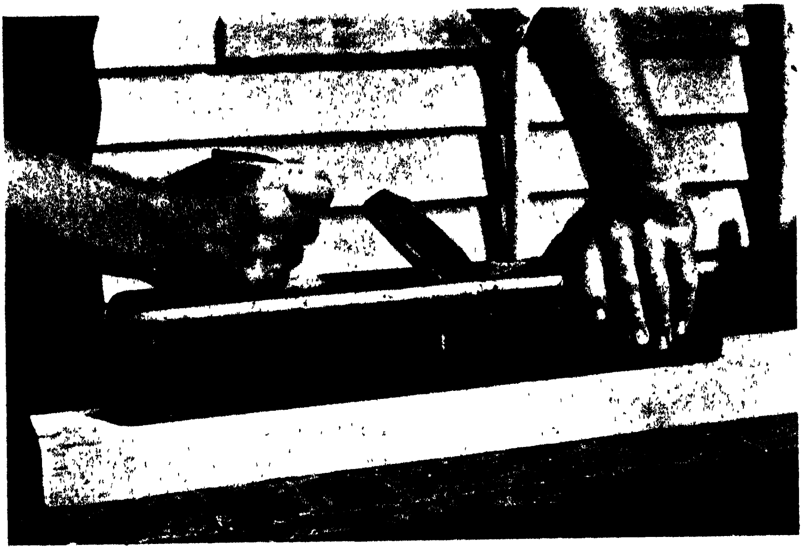


Fig. 15.—The Correct method of holding the Jack Plane while planing a surface.

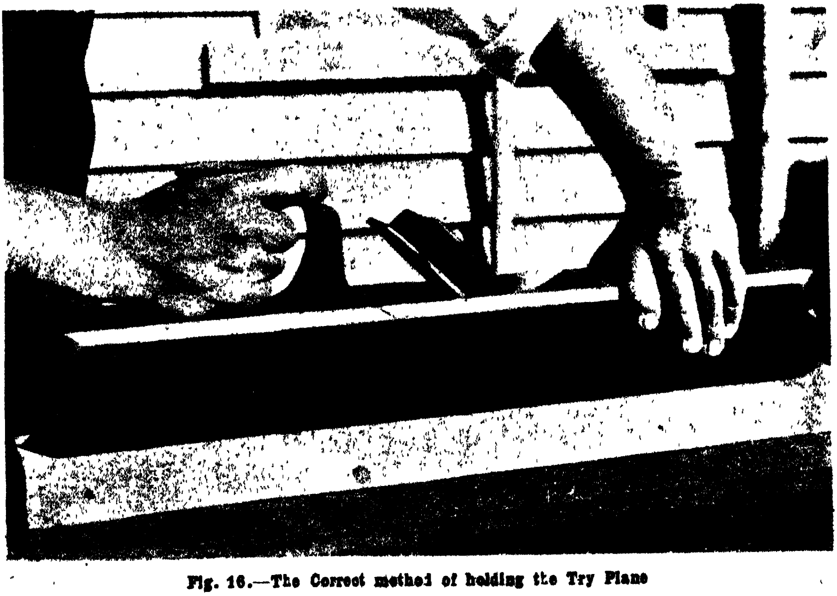


Fig. 16.—The Correct method of holding the Try Plane

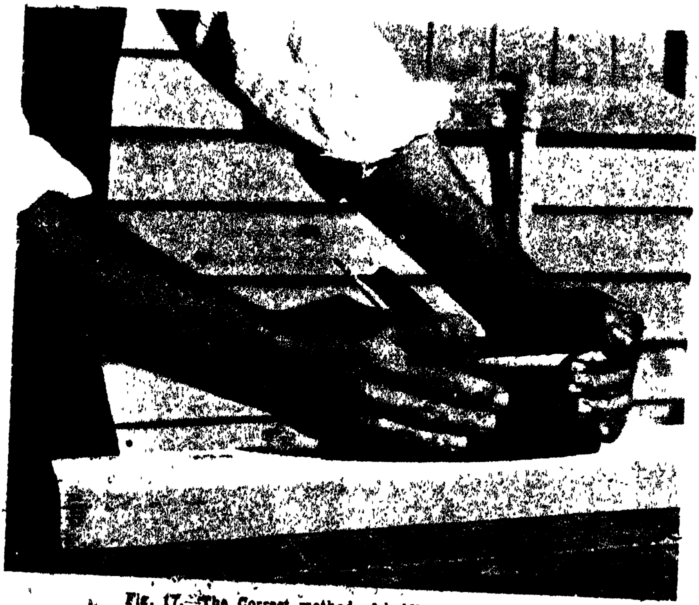


Fig. 17.—The Correct method of holding the Smoother.

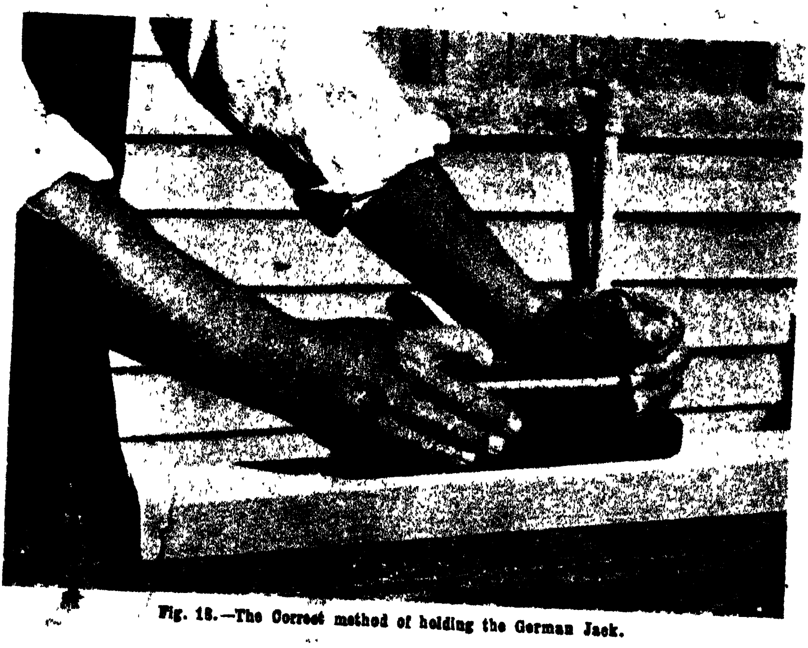


Fig. 18.—The Correct method of holding the German Jack.

Many beginners have a bad habit of continually planing away where the plane will bite, but it has to be learned that the plane may be biting where further planing is only spoiling the job. It is an illusion to imagine that because shavings are coming off that that is the spot for further planing. Sometimes a hollow exists where the plane is not biting, and it is necessary to work the hollow out. To do this the high portions of the timber must be planed off until the plane takes an even shaving off the full length. Sometimes the failure of the plane to bite is due to the condition of the tool.

The face side of the timber, which is the most important, must be made quite true. From it the "face-edge" is next worked straight and square. This is done with the same set of planes and also with the square. The brass plate of the square must be kept up against the face side, bringing the steel plate down on the edge, and drawing it from end to end to ensure that no daylight can be seen under the steel edge. The face-edge must be tested with the square until it is right, and at the same time watch must be kept along the edge to see that it is true. Having two sides thus trued and planed up, take the single-tooth marking gauge, set it to the finished thickness, and run the gauge round on the untouched sides, one at a time, gauging off the face side. The thickness of the timber has to be reduced to the gauge-line with the same set of planes. Both winding sticks and square are done with now, and there is only the gauge-line to watch.

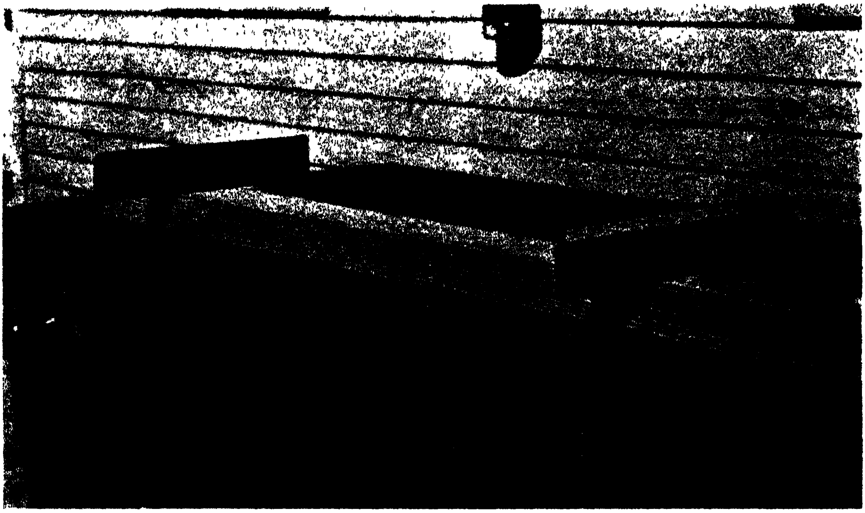


Fig. 19.—The Winding Sticks.

The width of the final side of the timber is gauged in the same way and planed down. If any smoothing has to be done it should be done now with the smoother, but only very lightly, or the timber will be put out of shape again.

CORRECTION.—Owing to the upper illustration on page 663 last month being turned upside down, the figure numbers were wrongly named. Figs. 3 and 6 were reversed and also Figs. 4 and 5.

(*To be continued.*)

Co-operative Marketing of Poultry Products.

CAPTAIN G. N. MANN.*

While making the following remarks on the general conditions of the poultry industry in this State, or on what I believe to be our paramount needs, I do not wish to create the impression that I rate myself a skilled observer, or highly qualified expert, but rather these are the remarks of a poultry-farmer who has invested his all in the industry, and who therefore considers no opportunity should be lost to urge upon his fellow poultry-farmers the ever-present necessity of keeping in touch with the needs of the industry.

We must develop more and more the determination to buy our requirements collectively, and sell our products collectively. Lip service is of no account; beneficial results will be gained only by single-minded devotion to a principle which we know from experience is the best method of developing the poultry industry along lines which will prove of greatest value to the greatest number of people

I am convinced we are merely the pioneers of the poultry industry in this country, for if by our co-operative effort we can continue to sell our products on the world's markets, the glorious climate the marked suitability of our country for poultry-raising, and the fact that our flush season is the season of scarcity and consequent high prices in the importing countries of Europe and North America—all natural advantages—point to the one fact that the opportunity now exists to win the right to satisfy an ever-growing share of the world's demand for poultry products. Only thus can our industry grow. I am equally sure that only through our own co-operative efforts can our products be placed on the world's markets in a manner that will stimulate demand for our goods, promote respect for our label, and at the same time secure for the Australian poultry-farmer full value for his product.

Co-operative activity means action by ourselves, for ourselves ; and when we succeed—as we surely will—then it is the community, the State and the nation as a whole, which benefits.

I claim for those who are guiding and directing this huge co-operative movement that they are fully alive to the fact that justice must be meted out to the community as a whole, otherwise our efforts would be in vain and our organisation would soon collapse. It must ever remain our duty and objective to endeavour to hold fairly and evenly the balance between producer and consumer, to secure for the former a fair and adequate return for his capital and labour, and to protect the latter from unfair exploitation Only thus can supply and demand be successfully regulated and prove beneficial alike to producer and consumer. Any attempt to secure an unfair advantage for either could only enjoy a very short-lived success, and retribution usually swiftly follows.

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*Paper read at the Annual Conference of Poultry Farmers, at Hawkesbury Agricultural College, 24th June, 1922.

Periods of glut and consequent low prices are inevitably followed sooner or later by periods of scarcity and inflated prices. This state of affairs is of no value whatever to either producer or consumer. Both are served best and achieve permanent, constructive growth only when stability is maintained, and fair average prices prevail.

Much has been accomplished along these lines during the last few years. Particularly was the improvement noticeable last year, when a greatly increased number of eggs were exported and returns were highly satisfactory, although most of the eggs were sold f.o.b., Sydney.

This year a determined effort is to be made to send direct consignments to London and other European markets, thus securing to producers full advantage of these oversea markets, which—based on past experience with dairy produce—will yield greatly enhanced prices, and at least we will have the satisfaction of knowing that we have obtained the true market value of our eggs Any improvement which can be effected in the grading and packing will be to our advantage, serving to improve the good name and reputation for quality already established in England for our co-operative eggs as distinct from other Australian eggs in England.

So long as the present standard of quality is maintained, so must the demand for our products grow, and with an ever-growing demand the future of our industry is assured. There is no limit to the possibilities of the poultry industry in this country, provided we can successfully develop export trade. Great expansion was accomplished last year, and still greater effort is being made this year. The one factor necessary to ensure complete success is the whole-hearted support of the co-operative pool by every poultry-farmer.

The financial conditions governing this year's pool have been made much easier for the farmer by spreading the necessary percentage deductions lightly over the whole year. The funds so accumulated will create a "special reserve fund" to be utilised for the development of existing export markets, opening up new channels of distribution overseas, as well as covering the necessary storage of any periodical surplus, and by this means providing for the inevitable and increasing shortage of supplies during the autumn and winter months.

The success achieved by the New South Wales poultry-farmers has already excited the admiration of poultry-farmers in other States, notably Victoria, where effort is being made to build similar organisations to ours, the outstanding feature of which is that the demand for improved conditions springs from the farmer.

Finally, I would express my conviction that, provided the poultry-farmer loyally and steadfastly supports co-operative marketing, the future prosperity of the poultry industry is assured, and the day is not far distant when this industry will rank high amongst the great wealth-producing industries of this State.

October Work in the Apiary.

W. A. GOODACRE, Senior Apiary Inspector.

UNDER normal conditions, many colonies in the apairy will have advanced to the populous and progressive stage during October, and this condition, combined with more settled weather, permits much progressive work to be carried out amongst the bees.

While particular attention has still to be given to the stores of the colony, it will be found in many cases that the more progressive stocks are gathering sufficient supplies to keep well ahead. With these progressive conditions obtaining, the first aim of the bee-farmer is to get all his colonies up to a high standard, and the best results are gained when certain factors are in evidence—notably, good hives with good combs, a good young Italian queen, and ample hive accommodation to prevent cramping of the brood nest and minimise swarming.

In connection with the giving of additional accommodation, there are many points worthy of serious consideration by the beginner. Let us discuss the building up during progressive times of a small colony established on four frames. The first comb against the wall of the hive will probably contain a good quantity of honey, and perhaps a small quantity of brood. The two adjoining combs will contain a large percentage of brood. The outside comb will consist chiefly of honey. Extra combs, or frames containing comb-foundation should, in this case, be inserted between the third and fourth comb; it is generally sufficient to give one at a time. This procedure of placing the empty combs or foundation at the side of the brood nest should be carried out as the colony requires it until the first hive-body has its full complement of frames.

I would not advise beginners to practice during spring the spreading of brood by separating the full brood combs and inserting empties between. The bees will extend the brood nest as quickly as they can care for the brood, and with less risk if the empty comb or foundation is placed at the side as previously mentioned.

When giving the first super to a colony, if comb-foundation only is in the frames, the bees will not readily accept it to work in. Some inducement by way of placing a frame containing some honey should be given. When a second super is required on the hive, it can be placed under the first super; the position of the new super will then be between the lower storey (brood chamber) and the first super. In a case where the brood nest is extended into the first super, it would be advisable to exchange the combs containing brood for empties from the newly-placed super over the brood chamber, so that the brood nest of the colony will not be divided.

At this period of the season ambitious beginners usually desire to further their operations by artificially increasing their colonies. They are, in some cases, under the impression that increase should be made during this month, but manipulations of this description must be governed more by conditions than by the aid of the calendar. The colonies on hand should be populous and progressive, the weather should be fine and warm, and a knowledge of locality should give some idea as to whether it is worth while to attempt increase. We hear of the experienced man increasing five colonies to twenty-five, and extracting honey from all before the end of the season; but experience means a good deal in such cases. While an ambitious beginner may take some risk and endeavour to increase his stocks, I consider that for a start to draw one nucleus from each populous and progressive hive would be sufficient. The parent colonies will then be still left in a good strong condition. Perhaps in a few weeks, if conditions are still good and the young colonies well on the up-grade, a few more nuclei could be formed, if desired. There are other methods of making increase apart from the forming of nuclei, but for the beginner, until some experience is gained, the nuclei method of artificial increase offers less risk to the welfare of the parent hive than many other plans.

During the extensive colony manipulations carried out early in the season, careful examination of the brood for any sign of disease is necessary. Serious results occur at times when a colony contracts foul brood, and becomes weakened and not in a fit state to protect its stores. In some cases these weak colonies will abscond, and leave their spore-laden stores for easy distribution amongst healthy hives. Know the condition of every colony, and prevent such a catastrophe.

The wax moth will now be busy, if given a chance, therefore, a careful examination should be made of all stored combs, and where necessary they should be disinfected with carbon-bisulphide. Valuable combs must not be left in the yard in hives that are not in use by bees. Apart from becoming a breeding-ground for wax moth, combs left unprotected in this way are often a medium for the spread of brood disease.

HARVESTING COTTON.

It seems odd, yet is a fact, that any cotton grower can raise about three times as much cotton as his hired help can pick. Unlike the harvest of corn, wheat, and other crops, where a machine cuts down the stalks and makes but one trip over the field for a harvest, there are three distinct crops to the cotton plant. This means a harvest period of two months or more, and thus eliminates the floating labour element and makes each plantation-owner entirely dependent upon his own help to pick cotton. Outsiders cannot be interested because of the slow and tedious nature of the work which brings such small returns, and has always been the task of the negro.—*The Scientific American.*

Storage Experiments with Lime Intended for Sprays.

A. A. RAMSAY, Principal Assistant Chemist.

NOT only is a certain difficulty sometimes experienced by the fruitgrower in obtaining lime of good quality for the preparation of such sprays as lime-sulphur and Bordeaux mixture, but even when a suitable lime has been procured and has given satisfactory results, there remains the problem of efficient storage. Quicklime becomes first air-slaked and is then converted into carbonate of lime, with the consequence that the resultant proportion of effective lime after storage constitutes a variable quantity, according to the quality of the original article and the conditions of storage. The preparation of sprays with the accuracy necessary for consistently good results becomes (in the absence of a knowledge of the article's exact constitution) almost impossible.

A series of laboratory trials with a view to determining how lime for orchard sprays may be stored with the minimum of deterioration and in what degree it suffers deterioration when stored by certain approved methods was commenced by the Department in November, 1921. The lime used in the experiments (supplied by a local firm) had a chemical composition as follows:—

	Per cent.
Moisture	Nil
Insoluble matter	·12
Oxides of iron, aluminium	1·34
Calcium carbonate	·41
sulphate	·24
phosphate	·30
oxide	87·70
hydroxide	9·00
Magnesium oxide	0·88
	99·99

This, upon slaking, would have the following composition:—

	Per cent.
Insoluble matter	·09
Oxides of iron, aluminium	1·04
Calcium carbonate	·32
sulphate	·19
phosphate	·23
hydroxide	97·13
Magnesium hydroxide	1·00
	100·00

For the purpose of this note the above may be condensed to:—

	Per cent.
Calcium hydroxide	97·13
carbonate	0·32
Other compounds	2·55
	100·00

Two quantities, each of 4 lb. of the original lime, were first weighed off. One of these was placed in a clean kerosene tin and 458 fluid ounces of water were added. After the reaction the actual measured volume of the lime-mixture was 429 fluid ounces; one ounce of dry lime (CaO) was therefore contained in 6·7 fluid ounces of the mixture, or 2·98 ounces per pint. It may be noted that the lime on first settling was 4⅜ inches above the bottom of the tin, and this settled to a depth of 3 inches after standing for fifty-four days.

The other aliquot of 4 lb. was placed in a large earthenware jar and 442 fluid ounces of water were added. After the reaction the actual measured volume of the lime-mixture was 414 fluid ounces; one ounce of dry lime was therefore contained in each 6·46 fluid ounces, or 3 09 ounces per pint.

The lime settled at first to 4⅝ inches from the bottom of the jar, and then to 3½ inches after fifty-four days.

Aliquots from these two vessels were withdrawn every month for analysis, and the results are given in the following tables:—

ANALYSIS at different periods of lime stored in a kerosene tin.

	November.	December (after 25 days)	January (after 54 days).	February (after 84 days).	March (after 112 days).	April (after 142 days).	May (after 172 days)
	per cent	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Calcium hydroxide	97·13	97·07	97 07	96·84	96·79	96·80	96·80
,, carbonate	·32	·38	·38	·62	·67	·66	·66
Other compounds	2·55	2 55	2·55	2·54	2·54	2·54	2·54
	100·00	100·00	100·00	100·00	100·00	100·00	100 00

ANALYSIS at different periods of lime stored in an earthenware jar.

	November	December (after 25 days).	January (after 54 days).	February (after 84 days).	March (after 112 days).	April (after 142 days).	May (after 172 days).
	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.	per cent.
Calcium hydroxide	97·13	97·10	97·06	96·86	96 76	96·74	96·71
,, carbonate	·32	·35	·39	·60	·70	·72	·75
Other compounds	2·55	2·55	2·55	2·54	2·54	2·54	2·54
	100·00	100·00	100 00	100·00	100·00	100·00	100·00

It will be noted from the above results that at the end of the test (after a period of 172 days) the increase in the amount of calcium carbonate is only 0·3 to 0·4 per cent., and that during that time the effective lime has therefore been reduced by that amount, or in other words, so far as the manufacture of sprays is concerned, the quality of the lime is nearly constant.

The kerosene tin used in the experiment is still bright, and shows no sign of rusting.

The Results.

It is therefore recommended that orchardists should first of all procure lime of good quality for the preparation of sprays; and that the lime so obtained should be kept under water, and used as required. Two methods of procedure suggest themselves:—

1.—Quantities of 4 lb. should be weighed off, slaked, and covered with water in a kerosene tin, and so kept until required. For the preparation of 50 gallons of Bordeaux mixture the contents of one tin should be taken, further diluted with water, and used as directed in the Department's bulletin (Farmers' Bulletin 72, "Spraying"). For larger orchards multiples of 4 lb. (say 8 or 16 lb. of lime, according to the amount of spray mixture which will probably be used) can be put down.

2.—Larger definite weights of lime may be placed in a barrel and made up either to a definite weight or a definite volume with water. Each aliquot then withdrawn will contain a definite quantity of lime, the amount of which can be simply and readily calculated.

These experiments will be continued for a further six months, the present preliminary note of the results obtained being made in order that orchardists may avail themselves of the information contained.

"LIVE STOCK AND FARM MECHANICS."

THOUGH essentially a text book for the agricultural student, and particularly for the members of boys and girls' clubs, there is much in this volume that will interest the farmer. In the first part it devotes a chapter to the exceeding value of live stock in relation to agricultural production, and then indicates how farm animals may be graded up and improved until they are more profitable to the farmer, compares one feed with another, and suggests the lines on which complete rations may be compounded. The points of the horse, of beef cattle, dairy cattle, pigs, sheep, and poultry, are all described in detail, with a view to helping a juvenile to select the best animal in his own class.

The second part is devoted to the practical subjects comprised within the heading "Farm Mechanics and Farm Management." The construction of farm buildings, use of concrete and various farm conveniences, handling of farm machinery, choice of a farm, planning out of a farm, book-keeping, and marketing of farm products, are subjects that each have a chapter or two devoted to them. A set of questions at the close of each chapter seeks to test the knowledge of the student and impress the lessons taught.

The author is Mr. John H. Gehrs, B.S., M.S., the head of the Department of Agriculture at the South-east Missouri State Teachers' College, who has already published several useful books.

Publishers: The Macmillan Company Ltd., New York, from whom comes our copy.

Pure Seed.

GROWERS RECOMMENDED BY THE DEPARTMENT

THE Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Potatoes:—	
Carman, No. 1	Alf. Piper, Llangothlin.
Coronation	A. Pannach and Sons, Mt. Excelsior, Lavington.
	E. M. Herring, "Sheen," Batlow.
Early Manistee	Alf. Piper, Llangothlin.
Factor	J. Piper, jun., Llangothlin.
Langworthy	K. Bowen, Newport P.O., Orange.
Scottish Triumph	A. Pannach and Sons, Mt. Excelsior, Lavington.
Surprise	Alf. Piper, Llangothlin.
*Symington	H. F. White, "Bald Blair," Guyra.
†Teasdale	B. C. Meek, Hobby's Yards.
Maize:—	
Boone County White	J. Chittick, Kangaroo Valley.
Early Clarence	F. T. Dowling, Tumut.
Fitzroy	Manager, Experiment Farm, Grafton.
	J. P. Mooney, Taree.
Golden Beauty	J. C. Stitt, Carter's Island, Taree.
Golden Glow	J. F. Chick, Tenterfield
Hickory King	S. F. Herne Brundee, via Nowra.
Iowa Silvermine	J. H. Kerr, Little Valley, Elsmore, via Inverell.
Iowa Silvermine (2nd Quality)	S. C. Browning, Uralla.
Large Red Hogan	G. E. Levick, Taree Estate, Taree.
Leaming	J. Perrett, Miller's Forest, Hunter River.
Wellingrove	J. S. R. Crawford, Emu Swamp, Orange.
Yellow Hogan	J. Booth, West Kempsey.
Pop Corn:—	
Black Beauty	Manager, Experiment Farm, Bathurst
White Rice	Kable and Son, Orton Park, via Bathurst
Lucerne:—	
Lucerne	H. A. Mace, Fairview, Pallamallawa.
Clovers:—	
Shearman's Clover	J. H. Shearman, Fullerton Cove, Stockton.
Sorghums —	
Manchu Kaoliang	Manager, Experiment Farm, Bathurst.
Grasses: —	
Paspalum dilatatum	Manager, Experiment Farm, Lismore.
Elephant	Manager, Experiment Farm, Grafton.
	Manager, Experiment Farm, Lismore.
	Principal, H. A. College, Richmond.
	Manager, Experiment Farm, Cowra.
Kikuyu	Principal, H. A. College, Richmond.
	Manager, Experiment Farm, Lismore.
	Manager, Experiment Farm, Grafton.
Sudan	Manager, Experiment Farm, Bathurst.

NOTES:—*Symington variety has about the same characteristics as to yield and size of potatoes as Surprise and is otherwise similar, except that it shows a variation in the colour of the skin to Surprise.

†Teasdale variety is only cultivated in a small district, in which fairly good results have been obtained during the past few years. It is a white-skinned tuber, with pink blotched eyes.

Peanuts:—	
Chinese	Manager, Experiment Farm, Grafton. Principal, H. A. College, Richmond.
White Spanish	Manager, Experiment Farm, Grafton. Principal, H. A. College, Richmond. Manager, Experiment Farm, Yanco.
Broom Millet:—	
Broom Millet	W. G. Chaffey and Sons, Tamworth.

THE TICK BEAN AS GREEN-MANURE.

IN the *Agricultural Gazette* for November, 1919, page 776, a table was given showing the amounts of fertilising material added to the soil by the ploughing under of some of the ordinary crops used for green-manuring.

Since that was published, Mr. A. N. Shepherd, Inspector of Agriculture, stationed at Yanco, has forwarded samples of Tick bean grown on one of the farms on the Murrumbidgee Irrigation Area.

The beans were sown in March, irrigated on two occasions, and ploughed under at the end of July, when the yield of plants and roots was computed to be 10 tons 12 cwt. per acre.

It was not possible to obtain all the roots for weighing, as the top three inches of soil resembled a moss bed, so great was the growth of the smaller roots.

The following figures were obtained on analysis of this plant:—

Yield per acre.	Composition of whole plant.			Fertilising ingredients added to soils.		
	Nitrogen.	Phosphoric acid.	Potash.	Nitrogen.	Phosphoric acid.	Potash.
tons.	per cent.	per cent.	per cent.	lb. per acre.	lb. per acre.	lb. per acre.
10½	0·42	0·11	0·54	98	26	127

If these figures are compared with those given in the *Gazette* referred to, it will be seen that the amount of plant-food added to the soil by ploughing under a crop of this bean is very considerable, comparing favourably with such green manuring crops as cowpeas, oats and rye, owing principally to the higher acre yield. The proportion of potash is particularly high.—F. B. GUTHRIE.

NOT SUITABLE FOR TOBACCO.

ACCORDING to the report of the Tobacco Expert, after visiting the Tweed Heads and Murwillumbah districts at the request of local landowners, it is very doubtful whether leaf of commercial value could be produced in that part of the State, owing, firstly, to the proximity of the sea and its effect on the "burn" of the tobacco, and, secondly, to the difficulty of curing in a district with so large a rainfall after the harvesting season.

Poultry Notes.

OCTOBER.

JAMES HADLINGTON, Poultry Expert.

BY this month egg-production should have reached its highest point. The hatching season will be over, and many farmers will in consequence expect to have more eggs to market. Unfortunately this expectation is usually not realised, because as soon as it is time to cease putting eggs down for incubation there comes a little slackening in production. This has been a most noticeable feature of the last two years. Towards the end of October there has occurred quite a considerable and almost unaccountable falling off in production, such as was previously not expected until a month later.

During the next few weeks, therefore, the "peak" of egg-production will have been passed and will be followed by slightly lower tallies being made from month to month down to about May. However, the poultry farmer can do much by close attention to his stock, by careful feeding, and by such methods generally as are practised by the most skilful at their business, to ward off the heavy slump that sometimes takes place on many farms.

In this connection it may be observed that many poultry farmers, during the period of maximum production, get somewhat careless of the details that are necessary to keeping the birds up to that concert pitch in health and condition, which is so necessary to sustained egg-production. There are not a few who actually take the notion that their hens are likely to get too fat, and in consequence cut down or change their rations. Such action is inadvisable at any time, but more particularly at the summit of production.

Skill in Feeding.

Skill on the part of the attendant in feeding is one of the secrets in connection with high egg-production—yet it appears to most people such a simple operation to feed poultry! The fact of the matter is it is not altogether the elaborate expensive ration that sustains good production, but how it is fed. To simply throw food to poultry with a "there-you-are,-and-if-you-don't-eat-it-you'll-have-none-at-next-feed" kind of air, is not the way to obtain results. There must be a kind of sympathetic understanding between the attendant and the flock if the results are to be satisfactory. This is why many women can secure better results than men. When hens are laying there should be that kind of sympathy on the part of the attendant that questions: "Can they eat a little more; do they relish their food; have they nice clean water; is there plenty of shell grit for them; and are they comfortable and well supplied with all necessaries?" Without uch thoughtful care, it is not possible for the hens to do their best.

Culling too Early.

Poultry farmers will do well to avoid some mistakes made last year about October and early November in the way of culling out hens before they have finished their laying season. This practice was particularly rife on some soldiers' settlements, and in consequence there was a much smaller number of productive hens left as producers for the months November to March than there should have been. As far as could be ascertained this was the outcome of following the advice of inexperienced persons on matters of culling. What appears to have happened was that many hens, having gone through the period of heavy laying, had ceased for the time being, and in consequence their pelvic bones had more or less closed. This is often taken by persons with a little knowledge on the subject of the expansion and contraction of the pelvic bones as an indication that the hens have ceased to lay. So, indeed, it is, but with the bulk of such birds it is merely a temporary condition at that time of the year. Many such hens will come on to lay again in a short time, and some will continue profitable for months after. In this way the earning capacity of the farm may be considerably reduced.

All this points to the truth of the old adage that, a little knowledge is a dangerous thing. It also points to the folly of the novice allowing persons of limited experience to impose their amateur interpretation of otherwise sound principles of selection upon them. The writer came in contact with cases last year where as many as 250 hens had been culled from flocks of 700 (only half of which were second-year hens and the others first-year) before the end of November. Probably less than fifty should have been culled before the 1st of January. Certainly no such large number of ordinary hens that were being well tended would require to be culled so early.

True it is getting near the time when some of the hens that have been kept into their third laying-season may be expected to go off laying, but not a large proportion even of these. Later on—about the end of November or in December—a small number of hens in their second year of laying will be going off more or less permanently, but usually such hens show signs of breaking into an early moult; in fact, it is only hens that do so break up that it is safe to cull so early without risk of loss of production.

A Mistaken Idea.

Another mistaken idea that leads to lowered production is the reduction of the quantity of feed supplied to laying hens lest they should get too fat. This is one of the worst fallacies, and it is most obstinately held. It literally gets the novice like an epidemic disease, and many who should know better become more or less afflicted by it. Scores of cases have come under the writer's notice where egg-production had almost ceased even in the flush months through this folly of cutting down the food allowance of the hens—and in most cases for no parsimonious motives, but from this supreme folly of imagining that the hens will get too fat.

The poultry farmer should understand that cutting down the food with the idea of reducing, or preventing fat, means cutting off egg-production.

Feed well, but do not waste food, is the common sense of feeding.

Hens Eating Eggs.

Egg-eating is one of the troubles of the flush laying-season, and it is somewhat amusing to see the consternation of the average poultry keeper when he sees an egg being eaten by his hens. It is not much less amusing to see some of the remedies advocated for curing the hens of the so-called habit. The facts in this connection are that any hen will eat an egg once it is broken. When an egg-shell is broken from any cause, the hens will rush to eat it. However, this is not the true cause of egg-eating. If we designated the misdemeanour as "egg-breaking" it would explain the trouble.

When eggs are being eaten, first find out if they are being accidentally broken or broken by a hen that has acquired the vicious habit. In other words, we must find the "egg-breaker." One or two hens that acquire this habit will break an almost unlimited number of eggs, and will then be joined in their feast by their mates. In such cases it can well be imagined what loss can be sustained by even one or two hens who have learnt to break eggs.

The usual advice about using mustard, cutting the hen's beak, and so on, is little or no deterrent to such hens. There is only one effective remedy. That is, to get the egg-breaker and to put her (or them) out of the flock.

How should the egg-breaker be detected? Simply put an egg out in the yard or in some place where it can be watched. Take up a position where what goes on can be observed, and in all probability it will not be long before the hens that are used to eating eggs will be at it—rolling it about. These are not necessarily the real culprits, however. Watch for the particular hen that runs right up to the egg and dives her beak into it. Get her, or as many as do the same thing (often not more than one or two), and the trouble will be over.

DRY COPPER-CARBONATE FOR BUNT.

PROFESSOR W. W. MACKIE, of the University of California, has reported that the use of copper-carbonate dust to prevent Bunt in wheat is now practised by farmers over many thousands of acres in the three Pacific States.

An account of experiments on the use of copper-carbonate as a Bunt preventive was first given in the *Agricultural Gazette* of New South Wales, March, 1917,* and it was there pointed out "that dry copper-carbonate used at the rate of 2 oz. to the bushel of infected seed, gave better results than the standard method of dipping in bluestone and lime."

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* "The Prevention of 'Bunt,'" *Agricultural Gazette N.S.W.*, March 1917, G. P. Darnell-Smith.

Orchard Notes.

OCTOBER.

W. J. ALLEN and W. LE GAY BRERETON.

Spraying.

THE spring is a busy time with the spray pump for the apple, pear, and grape grower. Many smaller users of lime-sulphur situated some distance from Sydney who formerly found it convenient to purchase commercial brands of lime-sulphur, find that the high freights are making this commodity very costly. In a great many cases these users are quite aware that they can manufacture the concentrated article at home at far less cost, and are only deterred from so doing because they find a suitable boiler or cauldron too expensive.

The idea suggests itself that we hear a great deal just now about community singing; why not a community boiler for manufacturing concentrated lime-sulphur? Suitable cast-iron fire pans or boiling-down cauldrons can be obtained in Sydney at 1s. 9d. per gallon f.o.r., in sizes from 20 to 200 gallons. The cost of a suitable size would not be burdensome when divided between many. Though it is preferable where fuel is not plentiful to have the boiler set over a properly bricked-in furnace, this is not absolutely necessary, and a trench can be cut in the ground and lined with rock over which the boiler will sit and long wood fired in from either end of the trench. A lid made from stout cases should be provided or difficulty may be found in bringing the mixture up to the boil, though very little fuel will keep it boiling once the point is reached. The combined users should choose a central position with a suitable water and fuel supply close at hand.

Each user could make his own supply of concentrated mixture, but perhaps it would be better to arrange for one of the partners to do all the manufacturing and allow him for his time, as though concentrated lime-sulphur for home use does not call for a great deal of skill, still, like everything else, practice makes perfect.

The clubbing for common ownership of orchard machinery, especially spray outfits, has its own drawbacks, as so often all the owners wish to use the plant simultaneously. But in making concentrated lime-sulphur this is easily avoided. The concentrated lime-sulphur can be made in bulk and kept for some time in fully filled air-tight containers without appreciable deterioration; so that if each user provided himself with suitable containers each one could take his supply according to a prearranged roster and could dilute and use it just when he wished. Five-gallon oil drums or headed barrels of greater capacity which can be tightly bunged are suitable containers; the former is especially suitable for smaller users, as when a cask 's partially emptied air is imprisoned which will react on the lime-sulphur solution to some extent, even though the cask is tightly bunged. Moreover, the staves above the liquid become dry and shrink, and thereby allow the admission of air.

When a cask is in use it should have a brass tap screwed in to allow the required quantities to be readily drawn off without waste. When the tap is finished with it should be thoroughly rinsed and have some oil run through it; looked after in this way it will last for many years, but if the lime-sulphur solution is allowed to dry in it, it will be ruined in a very short time. To avoid long storing and the necessity of each user owning a great number of containers, the making of the concentrated solution could be arranged to suit the different spray periods, the users notifying their requirements, say, first for the dormant spraying to be taken on a certain date and for the spring and summer application at later dates. As each user may not own an hydrometer, one could be collectively owned and the solution tested and marked on the container when filled, but if the solution is kept over long periods in containers only partially filled or in containers not quite air-tight, it would be advisable to test again before using. In any case keeping over long periods should be avoided.

Suitable hydrometers are not expensive and it would be advisable for each user to have one. Departmental experiments have shown that there is no necessity to remove the sediment from concentrated lime-sulphur for home use, beyond what may be troublesome in the nozzles. To use the sediment as just described is quite a saving in time and material, but it is most important under these conditions that the concentrated solution shall be thoroughly shaken up each time before the required quantities are drawn off for use. The material for making the lime-sulphur should of course, be purchased collectively like all other orchard supplies. Full directions for making and diluting concentrated lime-sulphur can be obtained in pamphlet form on application to the Under Secretary and Director, Department of Agriculture, Sydney, free of cost.

Though we are looking for co-operation on far broader lines to spring from the Agricultural Bureau movement, combining to manufacture lime-sulphur could very easily be taken up by branches of the Bureau in districts where it is largely used.

Black Spot of Apple and Pear.

In some of the early districts apples and pears will have been ready during last month for their first application of fungicide, at the spur bursting to pinking stage, but in many of the tableland districts some of the apples will only be ready in the early part of this month.

Experiments have shown that the question, whether the first application should be made at the spur-bursting or somewhat later at the pinking or colouring stage, depends on the season. Indeed, in one season during an experiment in connection with black spot of pear, owing to a dry period in the early part of the spring, there was no development of the disease till after the petal-falling period, when rain occurred, and it is most probable that in that season the first application could have been delayed till the calyx stage.

However, as one cannot say what the weather is going to be it is not safe to omit the earlier application (from spur-bursting to pinking stage) even if the spring starts dry in districts liable to spot, as should the weather conditions become favourable for the disease the outbreak may occur during blossoming (when one wishes to avoid spraying) and then get such a hold that no subsequent treatment will appreciably check it that season. If the early applications are made, however, later applications can be increased according to the weather conditions.

With Williams pears on the coast, Departmental experiments have definitely shown that Bordeaux mixture is preferable to lime-sulphur as a spray for black spot, but owing to absence of outbreaks and other uncontrollable causes, experiments are inconclusive as to the best fungicide for this disease on apples and pears in the tableland districts. The action of Bordeaux mixture and lime-sulphur in other fruit diseases seems to suggest that Bordeaux mixture is generally the more efficient fungicide. The great drawback to its use on apples and pears, especially the former, is the damage it may cause through russetting the fruit. In districts where spot is not liable to be very severe it is preferable to use lime-sulphur, but in districts very favourable to the disease and where it is found necessary to use Bordeaux mixture to hold it, russetting can be avoided to a considerable extent by making the first application of Bordeaux mixture at an early spur-bursting stage. The majority of the blossom buds are then still clustered together, and have not fully emerged from the spur covering. Lime-sulphur may then be used for the subsequent application, up to the period of the second application of lead arsenate, when, if necessary, Bordeaux may be used again without danger of severe russetting.

Departmental experiments have shown that apples and pears are most susceptible to damage by russetting from Bordeaux mixture from the pinking stage till about five weeks after the petals have fallen.

The period for the application of atomic, atomised or colloidal sulphur for apple mildew coincide with those for lime-sulphur or Bordeaux mixture for black spot. Where a combined spray for mildew and spot is required the mildew sprays mentioned can be combined with lime-sulphur, but not with Bordeaux mixture. Leaflets dealing with the treatment for black spot of apple and pear and mildew of apple are obtainable from the Department free of charge.

Codlin Moth.

Precautions should be taken some time during the winter or before the grubs start to change to moths, again to block as far as possible the carry over of grubs from one season to another, as was pointed out in the July notes. If this has not been done, it is not too late yet to do some good work in this direction.

Any returned or second-hand cases that have been to the markets or that have held moth-infected fruit should be dipped. Where possible the packing house should be made moth tight and any moths destroyed at the windows each morning. The trees should be searched, and grubs sheltering in cracks or loose bark destroyed.

The first application of lead arsenate spray should be applied when the petals have fallen and before the calyx has closed.

Where it is necessary to combine lime-sulphur for black spot with lead arsenate, care should be taken in the way mixing is carried out. The concentrated lime-sulphur should first be diluted down with all but a few gallons of the full quantity of water required to reduce it to the correct strength. The lead arsenate should be reduced to a thin cream with the few gallons of water left out, and this cream then stirred into the diluted lime-sulphur, care being taken that the mixture makes the correct total volume

Care should also be taken that the relative quantities of concentrated lime-sulphur and lead arsenate to total quantity of fluid is maintained. The combination should be used at once and not held for any length of time.

The same care should be exercised when mixing Bordeaux mixture and lead arsenate or other combinations. Where woolly aphis is present tobacco wash may be combined with lime-sulphur or Bordeaux, or with lead arsenate, but in this case no soda should be used in making the tobacco wash Either tobacco wash or concentrated nicotine should be used for peach aphis. The main thing when dealing with this pest is to use a high pressure (not under 180 lb.), and to hold the nozzle close to each affected part to break up the clusters of the insects, giving them a very thorough drenching. If within two or three days of spraying any live aphis are left, the operation should be repeated. Peach aphis breed very fast, and if the second application be delayed too long they will have bred up as fast as they are killed.

The grape grower should be prepared for spraying with Bordeaux mixture for black spot and downy mildew and for treating with flowers of sulphur for oidium.

Leaflets on the treatment of the above diseases and the mixing of Bordeaux mixture, lead arsenate, tobacco wash, and the combining of sprays, are obtainable from the Department free of charge.

Cultivation.

This is such an important factor during the spring and summer months in the production of fruit in the majority of districts in this State that it seems wise to draw attention again to the instructions given last month on this subject. When cultivating citrus trees care should be taken, especially under coastal conditions, not to allow the horse implements too close to the trees.

Where farmyard mulch has been used round trees often luxuriant growths of weeds start up. These should be killed without delay, especially around young trees, or the mulch will result in more harm than good.

Where trees have been planted this season on soil that has not received a thorough winter saturation, they should be carefully watched, as they may require watering if there is a long spell without a substantial fall of rain. When watering such trees where irrigation is not available, open a basin round the tree a foot or so away from the stem and 8 or 9 inches deep; give three or four gallons of water, and after it has soaked away and is no longer boggy fill it again with dry soil. Follow up with cultivation near the trees after a few days.

FAULTY LIME IN BORDEAUX MIXTURE.

INQUIRIES from time to time come to hand regarding the condition of lime for the making of Bordeaux. Many growers not being in possession of a knowledge of chemistry are unable to realise the chemical difference existing between quick lime and air-slaked lime. As it is a matter that affects the vine-grower a few lines on the subject are not out of place.

If quick or fresh lime is exposed to the air for any length of time it combines with the moisture in the atmosphere, forming calcium hydrate or slaked lime, and this, by the action of the carbonic acid gas in the atmosphere, is gradually converted into calcium carbonate, commonly known as limestone. As further assisting in explaining, the chemical equation may be quoted as follows:—

CaO	+	H_2O	=	CaH_2O_2.
Calcium Oxide		Water		Calcium Hydrate
or				or
Quick Lime.				Slaked Lime.

CaH_2O_2	+	CO_2	=	$CaCO_3$	+	H_2O.
Calcium Hydrate.		Carbonic Acid Gas.		Calcium Carbonate.		Water.

In the making of Bordeaux mixture, the grower should always bear in mind that lime which has become carbonated should be avoided. When carbonated lime is used in a spray mixture, the chemical actions which take place are different from those when fresh burnt lime is used. Air-slaked lime, provided that it has not become carbonated, is as suitable as quick lime, though, of course, more would have to be used. A parcel of 100 lb. of quick lime on becoming slaked would weigh about 132 lb., and when it has become completely carbonated would weigh 178 lb. Even if sufficient faulty or carbonated lime is used to show an alkaline test on the litmus paper, it does not follow that all is well with the mixture, as amongst other substances formed in the mixing of bluestone and such lime paste, one would get carbonate of copper, which is injurious to the green tissues of the vine.—H. L. MANUEL, Viticultural Expert.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of thei forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue Alteration of dates should be notified at once.

Society.	Secretary.	Date.
1922.		
Berrigan A. and H. Society	R. Wardrop	Sept. 10
Millthorpe A. and P. Association	C. T. Hawken	Oct. 25
Tweed River A. Society (Murwillumbah)	T. M. Kennedy	Nov. 29, 30
1923.		
St. Ives A. and H. Association	A. K. Bowden	Jan. 12, 12
Kiama Agricultural Society	G. A. Somerville	,, 25, 26
West Bargo A. H. and I. Society	L. J. C. Hicks	,, 26
Wollongong A. H. and I. Association	W. J. Cochrane	Feb. 1, 2, 3
Inverell P. and A. Association	A. L. Varley	,, 6, 7, 8
Tahmoor and Couridjan	E. S. Key	,, 9, 10
Yanco A. Society (Leeton)	W. M. Evans	,, 13, 14
Shoalhaven A. and H. Association	H. Rauch	,, 14, 15
Dapto A. and H. Society	E. G. Coghlan	,, 16, 17
Guyra P. A. and H. Association	P. N. Stevenson	,, 20, 21, 22
Nepean District A. H. and I. Society (Penrith)	C. H. Fulton	,, 22, 23, 24
Newcastle A. H. and I. Association	E. J. Dann	,, 27, 28, Mar. 1, 2, 3
Robertson A. and H. Society	E. S. Martin	Feb. 28, Mar. 1
Alstonville Agricultural Society	W. J. Dunnetty	,, 28 ,, 1
Moruya A. and P. Society	H. P. Jeffery	,, 28, ,, 1
Oberon A. H. and P. Association	C. S. Chudleigh	Mar. 1, 2
Central New England P. & A. Assoc. (Glen Innes)	Geo. A. Priest	,, 6, 7, 8
Orange A. and P. Association	G. L. Williams	,, 6, 7, 8
Tumut A. and P. Association	T. E. Wilkinson	,, 7, 8
Bangalow A. and I. Society	W. H. Reading	,, 7, 8
Hunter River A. and H. Assoc. (West Maitland)	J. S. Hoskins	,, 7, 8, 9, 10
Berrima A. H. and I. Society	W. Holt	,, 8, 9, 10
Blacktown A. Society	J. McMurtrie	,, 9, 10
Rydal A. H. and P. Association	S. B. Prior	,, 10
Mudgee A. P. H. and I. Association	S. H. Somerville	,, 13, 14, 15
Cobargo A., P. and H. Society	T. Kennelly	,, 14, 15
Crookwell A. P. and H. Society	C. H. Levy	,, 15, 16
Camden A. H. and I. Society	G. V. Sidman	,, 16, 17
Batlow A. Society	C. S. Gregory	,, 20, 21
Campbelltown A. Society	J. T. Deane	,, 21, 22
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins	,, 21, 22
Royal Agricultural Society of N.S.W.	E. J. Rafferty (acting)	,, 26 to April 4
Moree P. and A. Society	C. G. Hobbes	Apr. 17, 18, 19
Narrabri P. A. and H. Association	E. J. Kimmorley	May 2, 3
Hawkesbury District Association (Windsor)	H. S. Johnston	,, 3, 4, 5

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Tractor Ploughing Trials.

TRANGIE EXPERIMENT FARM, SEPTEMBER, 1922.

L. S. HARRISON, Senior Agricultural Instructor.

ON being approached by one or two of the tractor importing firms with a request that a ploughing trial under supervision be held, it was decided by the Department of Agriculture to invite all tractor firms to enter for the test. This offer was accepted by quite a number, and finally six firms agreed to commence on 5th September, 1922

The trial was arranged to take place on the Government Experiment Farm at Trangie, situated 328 miles west of Sydney, under the strictest supervision. All tractors, ploughs, fuel, and lubricants to be provided by the competing firms, all ploughing to be at least 4 inches deep, and the area allotted to each to be completed within one calendar month from 5th September.

The paddock set aside for the trials was within 2 miles of the town, practically flat, and varied in length from approximately 80 chains to 91 chains. A furrow was opened up in the centre and on the outside of each 4-chain land, and was struck out by a horse team, making every land average about 33 acres or more. The paddock was divided into two for the purpose of equalising as far as possible the nature of the soil available for each machine, as there was considerable variation right throughout the paddock. Lots were drawn for positions, and each tractor was required to plough one block on the first portion and then another on the second. The sizes allotted to each varied from 66·2 acres to 70 acres, excepting the horse team which ploughed a half-block in each section, making 33·5 acres in all. The half area was arranged in order to enable the horse teams to complete about the same time as the tractors.

The paddock selected was an excellent one in every way for the trials, giving a clear demonstration to all interested of what a tractor could do with ploughs under conditions such as were met with at Trangie. The paddock was by no means an easy one to fallow, as it had a hard, packed surface for the most part, about two-thirds not having been ploughed since 1918 and the balance in 1920. The soil is of drift formation, mostly red loam, in places with very severe, raw, sandy, and scalded patches. On one side of the paddock is a number of gilgais (low black soil, sometimes known as myall country). Stumps and roots were very numerous just under the surface, and rain had not fallen for a considerable time, causing the paddock throughout to be extremely hard—excepting, of course, the sandy patches. Much dry rubbish was present, including wild mustard, bindii, a species of verbena, and spear grass, causing considerable trouble by blocking up the plough, making it practically impossible to cut on any but the wide cut.

Taking the conditions as a whole, the test was an extremely severe one, as it is probable that such ploughing would seldom be met with, and it is even open to question whether the average farmer would attempt to deal with land in such a condition as the majority of it was. Of course, quality of work must be considered in relation to depth when viewing the costs of ploughing, as it naturally follows that, within reasonable limits, the shallower the ploughing the lower the cost, and the farmer must take these points into close consideration when applying the figures to his own cultural operations. The consensus of opinion of representative farmers was that at least 10s. per acre would be demanded for contract work; however, that figure is only problematical, while those relating to the actual ploughing test are practically exact.

The Fordson Tractor.
Side View.

Doubtless the information supplied in this article as regards efficiency, economy, and general suitability when viewed in conjunction with the exact conditions appertaining to his own property, such as area, amount of available work (cultural, hauling, and stationary) that would keep the tractor as close to continuous employment as possible, should be an indication to any interested farmer as to whether it is advisable for him to procure a tractor. Its investment value, compared with other necessary expenditure on the farm, would also have to be considered. Furthermore, I am firmly of the opinion that to obtain the maximum result from a tractor such as those at work at Trangie, it should, within reasonable limits, be the care of one person with as much mechanical knowledge as possible, as deterioration

The Cletrac Tractor.
Side View.

The Cletrac Tractor.
Rear View.

in most cases would be rapid if in careless and uninterested hands. Unquestionably general farming operations would be more attractive (a matter of moment at the present time) when carried out with tractors than with horses, while equal working hours would only entail a fraction of the preparation. At certain periods of the year, too, it is essential that some work be hastened or otherwise abandoned, (many such cases readily come to the mind of all practical farmers), and the tractor is able to work long hours and cope with hurried conditions.

Taking this trial into view, the infrequency of the stops for repairs, replacements, and adjustments on the whole was remarkable and well worthy of note. It is recognised, however, that the drivers were, right through, far superior as mechanics to the general run of men who would be operating the machines in private hands, although close attention to the driving and operating of the competing tractors disclosed nothing that would not be readily picked up by a keen operator.

The Titan Tractor.

It was noticed that the wheel tractors each threw a slight ridge, except in the Jelbart, corresponding practically with the driving wheels. This, no doubt, was caused by the grips loosening the soil, all ploughs used being stump-jump ones. The Jelbart left a slightly pulverised surface, corresponding with the wheels, which were of a different type from the other tractors. The effect of this condition would, however, be quite negligible in most cases; in opposition to the foregoing, it must be pointed out that the self-laying track type (Cletrac and Renault) left a most even surface. The headlands throughout were satisfactory and reasonably short.

All tractors were worked as one-man outfits, but where assistance was rendered in making adjustments in the mid-day stop, or before commencement in the morning, the time so occupied is added and taken as running time. One hour was allowed in the evening for all adjustments and attention to machines, oiling, &c., but this time was rarely availed of in full by any machine.

Depreciation on tractors and ploughs is always problematical, and quite impossible of being determined on a trial covering such an area as 70 acres, but it is an extremely important item and must necessarily be taken into consideration. In any equitable system of determining this cost the number of working days per annum must be considered, including all operations, making allowable a probable maximum of 200 days. So, if a machine were to cost £250 and had an effective life of five years, it would be necessary to add the sum of 5s. to each day's work as portion of the cost. In a similar manner with the plough, about eighty days would most likely be the maximum number allowable and treated similarly. I have left the important item of depreciation out of the figures shown, as it is readily seen that authentic data on the point is quite unprocurable. It is possibly reasonable to assume that allowing a stated period of years (five or more, as the case may be) as the time in which the tractor should be fully written off, it would be worth at least the amount that had been spent on it for repairs. This is suggested as worth consideration when allowing the very doubtful period over which depreciation should be taken into account.

The Team at Trangie and their Work.

On arrival at the paddock all tractors had their fuel, lubricating oil, and water tanks emptied, and were filled again before commencement with their requirements accurately measured out. All tanks were measured in the evening and again next morning, when quantities were checked off, and on completion of the ploughing all containers were again emptied out and quantities measured. This action was taken to ensure the amounts used being accurately determined, and to make certain that no interference with the tractors had taken place. Costs of fuel are computed on prices at Trangie, together with costs of new tractors and ploughs at date of trials, reckoned on freight from Sydney, the figures as supplied by the representatives of each machine being taken. In the latter case the fact that all tractors were entirely standard was also stated by the representatives, supported by my own close personal observation. Grease and oil per acre have been arbitrarily allowed at 1d. for horse team and 2d. for tractors. Wages of drivers are reckoned at 16s. per day, no doubt a low figure for the class of driver in these trials, but reasonable for purposes of calculation. Eight hours' working time was taken as equal to one day. Interest is reckoned at the rate of 5 per cent. on the Trangie price of the tractors and ploughs (200 and 80 days respectively) and horses 160 days, and the figures for each outfit have been worked to an acre-basis. The amount of water used by each tractor is given in gallons for the full period. This commodity cannot be shown in pounds, shillings, and pence, but is a most important consideration in many cases, and it will be seen that much variation took place in the quantities used. Most of the tractors were fitted with water air washers to prevent delays with dust—a very necessary precaution in this case as the paddock was so dry and dusty, though for this purpose very little water is required. Throughout the trials no rain fell, with the exception of 14 points towards the end, this quantity being quite negligible. The area allotted to each was completed by all excepting the Jelbart and Fiat, both these tractors being withdrawn before their lands were completed, but to enable those interested to draw comparisons of costs, the figures and particulars of these two tractors are included.

The accompanying photographs show to a certain degree the quality of the work which was done, and it is regretted that no rear views are available of the Fordson and Titan tractors.

Fordson 20 H.P.

The area to be ploughed was 66·7 acres. Work was commenced on 5th September, using a four-furrow (converted from a five-furrow) McKay Sunshine stump-jump disc plough, 8-inch cut The tractor was standard throughout with 4-inch bore, 5-inch stroke, 1,000 revolutions per minute, four cylinder, four-cycle, weighing 2,425 lb., Holly vaporising carburettor, Ford magneto, with disc clutch, three speeds forward and one reverse, splash lubrication and thermo-syphon cooling. This tractor travels fast and throws the sod rather wide, although this was no objection when viewed in conjunction with the work done throughout. The ploughing showed a ridge (see previous note on this point). The work done on its No. 1 section was shallow, but it improved somewhat on No. 2, although throughout it left something to be desired in depth. The Fordson wheels on one side run in the furrow, but with the conditions as dry as they were this had no adverse effect. The sections ploughed by this tractor are described in the general review of the whole paddock, and there is no necessity for detailed statements of the conditions met with. The Fordson starts up on benzine, and when warmed up is switched on to kerosene.

PRICE.

Tractor	£283
Five-furrow plough	66

Time taken to plough area, 59 hours 50 minutes—equal to 7·473 days or 1·116 acres per hour; water used, 51¼ gallons.

	Pence.
Fuel, benzine, per acre	·57
Fuel, kerosene, per acre	31·285
Vac-Mobil B.B. lubricating oil, per acre	5·47
Plough and gear-box grease and oil, per acre	2·
Interest, per acre	3·011
Depreciation, per acre	——
Wages, per acre	21·505
Total cost, per acre	5/3·841

Cletrac 20 H.P.

The area allotted to this tractor was 68·4 acres. Work was commenced on 5th September. A six-furrow McKay Sunshine stump-jump disc plough, cutting an 8-inch furrow, was used. The tractor was standard throughout, with 4-inch bore and 5½-inch stroke, revolutions at 1,250 to the minute, four cylinder and four-cycle, with Kingston carburettor and Teagle magneto, disc clutch, and pump lubrication: one speed forward and one reverse and automatic governor; weight 3,420 lb. The cooling was on the pump system, with a very large fan. This outfit travels fairly fast, but left a very satisfactory and even surface, although the ploughing was shallow in places—more so on its first section than on the second, where considerable improvement was shown, although this work as well was somewhat shallow throughout. The tractor travelled on the unploughed ground and experienced no trouble whatever in the sandy patches; and in the case of the sections allotted, the general consideration of the whole paddock covers all necessary remarks. This type of track or caterpillar machine is very handy in turning at the end of the lands; some slight replacements were necessary, the intrinsic value being small, viz., two sparking plugs and two fan belts. The Cletrac starts on benzine and then runs on kerosene.

PRICE.

Tractor	£591
Six-furrow plough	74

Time taken to plough area, 54 hours 7 minutes—equal to 6·764 days, or 1·264 acres per hour; water used, 5 gallons.

	Pence.
Fuel, benzine, per acre	·437
Fuel, kerosene, per acre	29·398
Valvoline lubricating oil, per acre	6·213
Plough and gear-box grease and oil, per acre	2·
Interest, per acre	4·604
Depreciation, per acre	——
Wages, per acre	18·987
Total cost, per acre	5/1·639

Titan 10 H.P.

The area to be ploughed by this tractor was 66·2 acres, and work was commenced on 5th September, using a six-furrow, afterwards altered to a five-furrow International stump-jump disc, 8-inch cut. The tractor was standard throughout, with 6½-inch bore, 8-inch stroke, 575 revolutions per minute, two cylinder and four-cycle, automatic governor, weight 5,710 lb., force-feed lubrication, two gears forward and one reverse, K.W. magneto, own mixer type of carburettor, friction clutch, thermo-syphon cooling, started on benzine and thence on to kerosene distillate. The distillate was supplied by Fells in 45-gallon drums, and was convenient to handle as provision had been made for a tap, which eliminated waste and made handling easy, obviating largely, as with tins in cases, the possibility of leakage. This tractor travelled at a slow pace, ploughed a fair depth, but left a decided ridge on the surface (see note on this point), and portion of its No. 1 section (possibly one-quarter) was considerably harder than the average; but as against that, of course, the ploughing in the sheep tracks and scalded patches was very shallow. The Titan travelled on the unploughed land, and was supplied with a self-steering device.

PRICE.

Tractor	£465
Six-furrow plough	74

Time taken to plough area, 61 hours 56 minutes—equal to 7·742 days, or 1·069 acres per hour; water used, 310 gallons.

	Pence.
Fuel, benzine, per acre	·821
Fuel, distillate, per acre	42·349
Tractol lubricating oil, per acre	9·29
Plough and gear-box grease and oil, per acre	2·
Interest, per acre	4·56
Depreciation, per acre	——
Wages, per acre	22·45
Total cost, per acre	6/9·47

The Renault Tractor.

Side View

The Renault Tractor.

Rear View.

Horses.

The area of the half section to be ploughed was 33·5 acres, and work was commenced on 7th September; a four-furrow stump-jump plough was used, cutting a six-inch furrow, and most excellent work as to depth and surface was done throughout. Six horses were used, and are here valued at £30 per head with harness; wages of driver, 13s. per day; plough to cost (as others) £57. Depreciation and interest are treated similarly to the tractor outfits.

Feed consumption was taken at 40 lb. of chaff per head per day, at £6 per ton, with 4 lb. of cracked maize at 7s. per bushel, and 2 lb. of oats at 3s. 4d. per bushel.

Time taken to plough area, 41 hours 30 minutes—equal to 5·187 days, or ·807 acres per hour.

Cost per acre of feed, wages, interest, grease, and without depreciation, 4s 11·911d.

Renault 22 H.P.

The size of the block for this outfit was 67·6 acres, and ploughing was commenced on 8th September, with two five-furrow McKay ploughs, one a Sunshine stump-jump and one a Sunstar stump-jump, both cutting an eight-inch furrow. The tractor was standard with 95-mm. bore and 140-stroke, and 1,100 revolutions to the minute; four cylinder and four-cycle; weight 7,280 lb., Renault carburettor, S.E.V. magneto, cone clutch: three speeds forward and one reverse, thermo-syphon cooling and pump lubrication: this tractor, being a track or caterpillar type, was also easy of manipulation and experienced no trouble at all in the sandy patches. The ploughing done by this outfit was quite satisfactory, being of good depth, and leaving a most excellent surface in spite of the fact that the operator was inexperienced at ploughing and had great trouble in freeing his plough of the rubbish. The tractor travelled on the unploughed land. The Renault runs on benzine throughout.

PRICE.

Tractor	£972
Two five-furrow Sunshine ploughs	132

Time taken to plough area, 53 hours 57 minutes— equal to 6·744 days, or 1·253 acres per hour; water used, 41½ gallons.

	Pence.
Fuel, benzine, per acre	73·304
Vac-Mobil A. lubricating oil, per acre	1·671
Plough and gear-box grease and oil, per acre...	2·000
Interest, per acre	7·793
Depreciation, per acre	——
Wages, per acre	19·154
Total cost, per acre	8/7·922

The Jelbart Tractor.

Side View.

The Jelbart Tractor.

Rear View.

Jelbart 8 H.P.

The area allotted to this tractor was 70 acres, work being commenced on 9th September, and of this quantity 52·57 acres were ploughed when the outfit was withdrawn. Two six-furrow McKay Sunshine stump-jump disc ploughs were used, cutting an eight-inch furrow. The tractor was standard, having 7¼-inch bore and 9½-inch stroke, with 400 revolutions per minute, and single cylinder two-stroke valveless engine; weight 7,280 lb. Thompson-Bennett magneto, vaporising carburettor, chain belt clutch, hit and miss governor, thermo-syphon cooling and two speeds forward and one reverse. The tractor travelled on the unploughed land and had a self-steering device. This machine had trouble in the sandy patches, which were severe, and found it necessary to plough in those areas with one plough, and whereas in the first section the work done was rather shallow, in portion of the second section some improvement was shown. This machine started on benzine, thence to kerosene, and finally ran on residual oil, supplied by the British Imperial Oil Company in 60-gallon drums without a tap hole, making it necessary in this case to syphon the liquid out, a rather unsatisfactory method.

PRICE.

Tractor	£687
Two ploughs	148

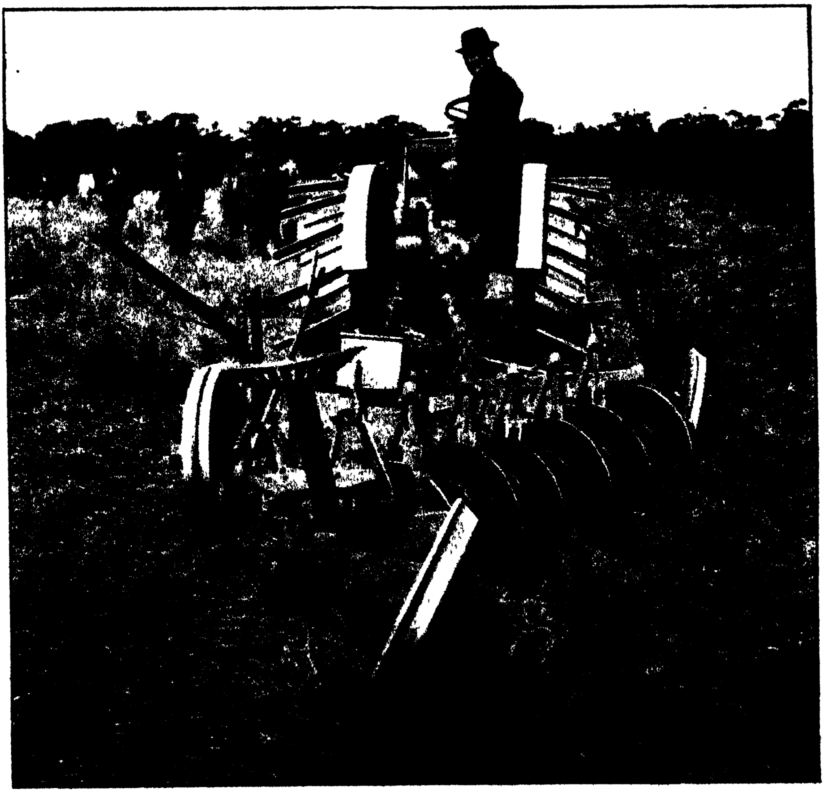
Time taken to plough area, 54 hours 1 minute—equal to 6·752 days, or ·973 acres per hour; water used, 134½ gallons.

	Pence.
Fuel, benzine, per acre	2·688
Fuel, kerosene, per acre	1·59
Fuel, residual oil, per acre	21·00
Jelbart cylinder oil, per acre	1·469
Plough and gear-box grease and oil, per acre...	2·000
Interest, per acre	8·146
Depreciation, per acre	——
Wages, per acre	24·666
Total cost per acre	5/1·559

Fiat 25 H.P.

The amount this outfit had to plough was 68·4 acres, and work was commenced on 11th September. Of this area, 58·15 acres were ploughed when the tractor was withdrawn. The plough used was a six-furrow McKay Sunshine stump-jump disc, cutting an eight-inch furrow. The tractor was standard, having 105-mm. bore and 180-stroke, and 900 revolutions per minute; four cylinder and four-cycle; Dixie magneto and Fiat carburettor; disc clutch and automatic governor; pump lubrication and cooling, with three speeds forward and one reverse. The tractor travelled

The Fiat Tractor.
Side View



The Fiat Tractor.
Rear View.

on the unploughed land and experienced great difficulty in the sand, which was very severe. The quality of the work as far as it was done was quite good, showing a slight ridge. This machine started on benzine and ran on kerosene, but later ran on a mixture of kerosene and benzine.

PRICE.

Tractor	£583
Plough	74

Time taken to plough area, 65 hours 25 minutes—equal to 8·177 days, or ·888 acres per hour; water used, 21⅓ gallons.

	Pence.
Fuel, benzine, per acre	22·442
Fuel, kerosene, per acre	42·567
Vac-Mobil B.B lubricating oil, per acre	9·860
Plough and gear-box grease and oil, per acre	2·000
Interest, per acre	6·479
Depreciation, per acre	——
Wages, per acre	27·027
Total cost, per acre	9/2·375

Conclusion.

In any future trials of a similar nature carried out, I would strongly recommend that in addition to severe ploughing tests, somewhat as this one, cultural work (either harrowing or spring-tooth cultivating on soft ground), road hauling (weight to be in proportion to stated draw-bar pull), stationary work over a reasonably protracted period, and dynamometer tests be included.

I wish to take this opportunity of thanking all firms represented for their close co-operation, and Mr. Squire, Experimentalist at Trangie Farm, for his valuable assistance.

AGRICULTURAL RESEARCH.

AGRICULTURE is subject to special hazards resulting from weather and climatic conditions, animal and plant diseases, and insect pests. These hazards reduce farming to a gigantic gamble. But methods of production can be adapted to the end of reducing losses from climatic and weather conditions to a minimum. Plant and animal diseases and insect pests can to a certain degree be controlled, but the means and the method of reducing or controlling these hazards cannot be worked out on the farm by the individual farmer. The investment, even of the largest, is not sufficient to permit of the organisation necessary for the study and formulation of these means and methods. A programme of agricultural development must, therefore, include provisions for an expanded and co-ordinated programme of practical and scientific investigation through State and National departments of agriculture, and through agricultural colleges and universities, directed toward reducing the hazards of climatic and weather conditions, and of plant and animal diseases and insect pests.—Report of the Congressional Joint Commission of Agricultural Inquiry, U.S.A., December, 1921.

Some Phases of Wheat Culture.

G. C. SPARKS, Inspector of Agriculture.*

UNTIL comparatively recently the object of the farmer has been essentially to provide a set of conditions in the seed-bed eminently favourable to the growth of the plant, but the method has omitted to devote that amount of attention to the plant itself that experience has proved necessary. The aim in the past has been to perfect the plant's environment by the provision of a moisture-laden, fine, compact disease- and weed-free seed-bed, overlying a subsoil carrying a large proportion of the previous winter's rain, and to apply at seed time a requisite amount of a suitable fertiliser. But, as it is now understood, it does not matter how thorough and skilful the cultivation has been or how intelligently the soil has been manured, maximum yields cannot be secured unless the seed is of a variety suitable to the soil and climatic conditions of the farm, and of the best possible type and highest yielding strain of that variety.

The selection of the best variety or varieties, whether for early, mid-season, or late sowing for grain or for hay, can safely be made upon the data afforded by the local farmers' experiments, bearing in mind that the recommendations based upon these experiments are the results of many seasons' operations, in which due consideration is given to various other vital points in the characteristics of the wheats, their disease resistance, straw strength, ability to hold grain, &c., all of which have important bearings upon yields.

It will have been observed that frequently the yields of various wheats in the experiments have under identical seeding and growing conditions varied to the extent of bags per acre; therefore the extreme importance of a judicious selection of varieties in order to secure the greatest possible yield.

The next thing should be to secure absolutely pure seed of the best type of the varieties in question, and then by a rigorous and long-sustained system of selection endeavour to improve that strain or at least to maintain its purity and productivity. There is a popular impression that frequent changes of seed are essential if yield is to be maintained, but unless the change is of direct and immediate benefit in securing purer, stronger, and otherwise more desirable seed, no good is likely to result from the change; and further, there is always the danger of the introduction of weed and disease. Unless, indeed, the seed has been subjected to some form of selection and has in consequence some features of outstanding merit, it is very unlikely that it will yield more heavily than local seed.

It is not suggested that much time should be devoted to the work of selection, nor that an elaborate system be developed, but it is certainly very profitable for every farmer to endeavour to improve his own seed by

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***Notes of a lecture delivered before the Cunningar branch of the Agricultural Bureau in June, 1922.**

ordinary care and some form of selection, and the ultimate effect in the aggregate will be very marked. The use of the grader and the rejection of all but the best possible sample for seed purposes is to be very strongly urged. Quite apart from the elimination of weed seeds and all shrivelled and broken grain, which may be used with advantage as feed, grading alone is a form of selection, for by grading, plump grain, the product of the most vigorous plants is usually rendered available for seed; and apart also from the former considerations, graded seed will, under usual conditions, outyield an ungraded sample by one or two bushels per acre.

But the farmer can go much further than this by carrying out a system of modified individual or mass selection, the former being the most effective, the latter the easiest to adopt. Mass selection simply means the selection of any remarkably good plant or plants and the subsequent multiplication of their seed; but individual selection, though more troublesome even in the extremely modified form suggested here, goes much further.

The following suggestions may be found helpful:—A small amount of the best seed available is sown on clean fallow, and at harvest sufficient seeds are selected from the finest plants to give, say, 5 lb. of graded seed. This is again sown, clean fallow being employed on all occasions, and at harvest a further selection of the finest heads is made—the residue of the plot being sown as ordinary seed and the selected heads becoming the stud plot for next season. By doing this a continued selection is made from the best plants, and the result must be the development of a high yielding strain. Although this may seem somewhat complicated and laborious, the system has been adopted by several farmers in the southern district with very happy results.

Upon the treatment of the seed between harvest and seeding depends very largely its germinating power. The use of modern machinery enables grain to be harvested before it has attained the state of dryness necessary for harvesting with the stripper; and further, the immediate bagging from the seed-box of the machine is not as productive to dryness as was the old practice of dumping into heaps in the paddock and winnowing. Any moisture in the stored grain now has a more or less detrimental effect.

The necessary treatment of the seed for the control of smut has also very frequently a lowering effect upon germination. The two agents in common use—bluestone and formalin—differ in one or two respects. They are equally effective in the control of the disease, but formalin exerts a much less harmful effect upon the grain, provided it can be prevented from drying. If the seed can be treated and sown almost at once upon a moist seed-bed where immediate germination is certain, formalin will probably give best results, but if formalin-treated seed is allowed to dry thoroughly or is sown on a dry seed-bed and germination is delayed much damage to the grain may be expected. Bluestone, on the other hand, while being deadly to any damaged grain, and also exerting a retarding effect upon germination, is absolutely safe to use on dry seed-beds. Indeed bluestoned seed that is dried and held will frequently give a better germination than the same seed sown immediately after being bluestoned. Hence, under one special condition bluestone is naturally the most popular of the two. In the case, however, of seed harvested under moist conditions, and in which case damage to the seed coats is to be anticipated, bluestone is rather deadly, and increases in the amount of seed used are to be recommended in our normal dry, hot harvest weather. Any damage to the grain under such conditions usually results in cracking, and this cracked grain can be readily seen and removed by grading, but in wet harvest weather the grain toughens, and injury frequently results in tearing of the coats instead of cracking. This form of injury is much more difficult to contend against, as the damage is usually invisible to the ordinary observation, and the damaged grain is not capable of removal by grading, and is subject to severe injury by the bluestone pickle. The trouble was marked following the wet harvest weather of 1920-21, and is to be guarded against most easily by increases in the seeding amounts following wet harvests.

MINERALS AND ANIMAL GROWTH.

"THERE is probably no subject in nutrition on which information is more needed than the mineral requirements of animals, and the best combination of foodstuffs to provide a ration with properly balanced minerals," write J. B. Orr and A. D. Husband, of Rowett Research Institute, Aberdeen, in the *Scottish Journal of Agriculture.* "Further knowledge would enable us to get more rapid gains in weight and a more economical use of feeding-stuffs, and would also probably throw light on many conditions of malnutrition whose causes are at present obscure."

Even with our present limited knowledge, conclude the writers, it is possible to state some facts that are worth keeping in view in arranging rations. These facts they enunciate thus:—

1. Failure to grow at the maximum rate and also certain diseases may be due to a deficiency of certain minerals in the food or a lack of the proper proportion of the minerals to each other.

2. Lime, one of the minerals which is required in large amounts, is markedly deficient in grains and grain offals.

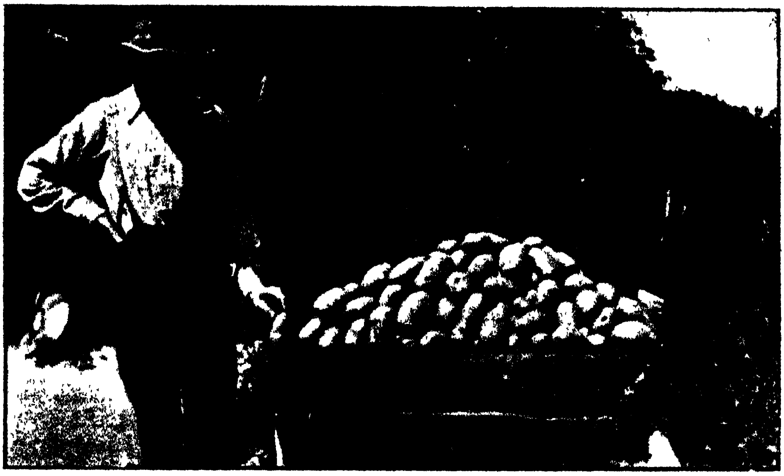
3. Green foods, especially leguminous plants like clover, are rich in lime. These and foods derived from them, such as silage and clover hay, correct the mineral deficiency of grains and meals.

4. The value of milk and milk residues, such as whey solids, which contain most of the mineral matter of the milk, is largely due to the fact that they contain all the essential minerals in the amounts and proportions required by the growing animal, and the well-recognised value of clover pastures, leguminous silage, fish meal, and other foodstuffs rich in lime depends largely upon the fact that the mineral matter contained in them corrects the deficiencies of grain, grain offal, and many other concentrates."

A NOVEL METHOD OF GROWING POTATOES.

THE remarkable yield of potatoes that resulted from one tuber treated to a novel method of cultivation was featured as a non-competitive exhibit at the last Tingha Show by Mr. A. J. McIlveen, of Stannifer, *via* Glen Innes.

The tuber was of Up-to-Date variety, and was cut into two sets and planted on 26th September, 1921. When the shoots were 2 or 3 inches above the ground, the plants were dug and the shoots transplanted in the manner adopted with sweet potatoes. The size of the plot was 30 feet by 6 feet. The potatoes were dug on 7th February, 1922, and gave a total yield of 126 lb., of which 112 lb. were of marketable size.



The product of two potato sets.

The rainfall was fairly good throughout the growing period, only one watering being given in November. The soil is a sandy loam, and had received a light dressing of farmyard manure some time prior to planting.

Mr. A. J. Pinn, Special Agricultural Instructor, commenting on this yield, remarked on the possibility of utilising such a system for increasing the supply of a limited quantity of seed when such action might be desirable, as in the case of a new variety.

The accompanying illustration shows the 112 lb. of marketable tubers. The potato held at the end of the table is approximately the same size as the original parent tuber.

TREES ON EARTHEN DAMS.

TREES are sometimes planted on earthen dam walls with the idea that the roots of the trees will bind the soil together, and so prevent the bank from wearing off too rapidly. Willow trees are often put in; but this is a mistake, as the roots in growing into the bank make miniature tunnels through the soil, and if these roots come to die and decay the channels are left, and the water has a better chance than ever to get through the wall. Vegetation should certainly be encouraged on dam walls, but only small stuff, the roots of which do not go deeply into the soil. Small bush and grass is better than large trees.—*Journal* of the South African Department of Agriculture.

The Clarence River Maize-growing Contest.

W. D. KERLE, Senior Agricultural Instructor.

A MAIZE-GROWING contest, similar in detail to that conducted by the Manning Agricultural and Horticultural Association, Taree, in the 1920-21 season, was inaugurated by the Clarence Pastoral and Agricultural Society, Grafton, last season.

The contest, which had for its object the determination of the highest yielding varieties or strains of maize in the district, excited much interest. Had the previous maize season not ended so disastrously—thousands of bushels of maize being lost by severe floods in May and July—the entries would have been more numerous. Altogether fifteen entries were received, six being non-competitive entries made by the Department of Agriculture with varieties from the Grafton Experiment Farm and the lower coastal rivers. The local farmers who competed were:—

A. J. Miller, Ulmarra.
H. J. Dix, Carr's Creek.
T. J. Ford, Grafton.
W. G. Leonard, Great Marlowe.
F. R. Crispin, Carr's Creek.
W. H. Paine, Great Marlowe.
G. H. Turner, Carr's Creek.
Stephen Paine, Grafton.
W. Gear, Great Marlowe.

The seed entered was mostly of good type and colour, but four or five samples were badly affected with weevil, which was the more unfortunate in view of the fact that the task of keeping seed maize free from weevil by the carbon bi-sulphide method is easy, cheap, and efficient. Indeed, if the Clarence River farmer desires to develop the seed maize business—and one inevitable result of these contests will be a big impetus in that direction—he will have to give much more attention to the treatment of his seed for weevil.

Varieties entered by Farmers.

The winning variety, entered by Mr. A. J. Miller, has been named by the Department Ulmarra Whitecap, and is evidence of the keen personal attention bestowed by Mr. Miller on the selection of his seed. Some four or five years ago, when Mr. Miller was growing the old Whitecap Horsetooth, he introduced a variety of Yellow Dent maize, secured in the district, to improve the colour and bushel weight. It is practically certain that this yellow variety is that grown at the Grafton Experiment Farm and recently named Fitzroy, and which was also obtained originally from a local source. In selecting his seed maize, Mr. Miller has followed closely the lines advocated by the Department in its publications, to which he attributes his success in no small measure. It is indeed pleasing to note that the selection of seed maize by these methods is meeting with success in the hands of practical farmers.

Ulmarra Whitecap maize presents the appearance of a generally yellow maize with a tendency to have many grains of a white appearance on the crown. It has fairly large cobs, which appear to have a mixed colour, but the white colour, as stated, is mostly confined to the cap of the grain. It has not the bright yellow colour and uniform appearance associated with Fitzroy.

RESULT OF CLARENCE P. AND A. SOCIETY CONTEST, 1921-22.

Competitor.	Variety.	Yields at Carr's Creek.		Yields at Great Marlowe.		Average Yield per acre.	
		bus.	lb.	bus.	lb.	bus.	lb.
A. J. Miller	Ulmarra Whitecap	104	54	82	53	93	54
H. J. Dix	Fitzroy	99	45	78	32	89	11
T. J. Ford	Improved Horsetooth	91	19	85	53	88	36
*Dept. of Agriculture	Fitzroy	96	7	80	18	88	13
W. G. Leonard	,,	90	34	76	6	83	20
F. R. Crispin	,,	91	27	74	36	83	4
W. Gear	,,	88	22	75	21	81	50
G. H. Turner	,,	89	7	72	52	81	21
*Dept. of Agriculture	Large Red Hogan	85	4	75	7	80	6
* ,, ,,	Pride of Hawkesbury	87	37	67	15	77	26
* ,, ,,	Leaming	78	46	63	19	71	5
* ,, ,,	Yellow Hogan	71	46	69	27	70	37
Stephen Paine	Georgie Gregor	75	49	55	16	65	33
W. H. Paine	Fitzroy	70	19	58	24	64	22
*Dept. of Agriculture	Narrow Red Hogan	62	34	64	18	63	26

* Non-competitive.

Mr. H. J. Dix entered his variety as Boyd's Pride. This is a variety similar in many respects to Fitzroy, of which it is undoubtedly a strain. It was secured from a farmer on the lower Clarence some years ago. It is evident that Mr. Dix, who is also a successful maize exhibitor in local shows, has selected the right type of seed to secure high yields.

The variety entered by Mr. T. J. Ford (Improved Horsetooth) is a yellow variety with a grain somewhat similar to Fitzroy, but longer and narrower. The seed entered was taken from half a bushel with which Mr. Ford secured first prize at the previous Clarence P. and A. Society's Show, and speaks well for his ability in recognising a high yielding strain of maize, and being able to select seed of the right type for yield.

Mr. W. G. Leonard's entry was unnamed, but was undoubtedly a strain of Grafton Farm's Fitzroy, as also was that of Mr. G. H. Turner, although called by him Carr's Beauty.

Mr. W. Gear's seed was lighter in colour than Fitzroy, but may be taken to be a rougher dented and more starchy type of that variety.

Both Messrs. F. R. Crispin's and W. H. Paine's seed were of a type very similar to Fitzroy, but showing slightly different characters in selection. The latter's seed was very badly affected with weevil.

Georgie Gregor was the name given to an entry by Mr. Stephen Paine. It is a small, long-grained yellow variety, showing characters very close to Small Horsetooth, but with a reddish tinge.

Varieties entered by the Department.

The non-competitive entries by the Department of Agriculture are too well known to need description. Pride of Hawkesbury, one of the best varieties grown on the Hawkesbury, was procured from a farmer who won the Grand Champion prize at the Royal Agricultural Show, Sydney, in 1921. This variety, although out-yielded, created a good impression on account of the very large size of its ears and its attractive grain. Unfortunately it suffered somewhat in yield through indifferent germination.

Large Red Hogan was the winning variety in the maize contest on the Manning last season, but it did not yield up to expectations on the Clarence.

Yellow Hogan is a fine looking, bright yellow sample of maize from the Macleay, where it is largely grown. This variety has taken prizes for several years at the Kempsey show.

Narrow Red Hogan was obtained from a Hunter River farmer, and it has a high reputation for yield in that district. In both plots in this contest it was badly attacked with leaf blight and presented a very stunted appearance.

Fitzroy and Leaming were secured from Grafton Experiment Farm, where, by systematic selection and careful breeding, extending over a number of years, they have been well improved and have reached a well-deserved position as standard varieties for early (Leaming) and late (Fitzroy) sowing on the coast.

The Plots.

Three farmers signified their willingness to have the contest conducted on their farms, viz.:—

W. H. Paine, Great Marlowe.
F. R. Crispin, Carr's Creek.
G. Lickiss, Southgate.

Owing to unusually dry weather it was not possible to sow the Southgate plot, but planting took place on 14th and 16th December at Great Marlowe and Carr's Creek respectively. Both sites were very uniform and of rich alluvial loam typical of the best Clarence River maize land. The previous crops in each case have for many years been maize, and no artificial fertiliser was used in this contest or previously on this land. Both were in excellent condition at time of sowing, being ploughed three times and then harrowed just prior to planting. The seed was dropped by hand (to secure uniformity) three grains every 3 feet, in drills 4 feet apart, covering being effected in each instance with the scuffler.

The season was not very satisfactory, the rainfall being very erratic. A week after planting very heavy rain fell, and this was followed by a month of abnormally dry weather in January. Further downpours in February, when over 20 inches were recorded, were succeeded by two months in which practically no rain of any use to the crops fell. The February rain, however, falling at the most critical stage in the plants' development, was largely responsible for the very satisfactory yields.

Harvest operations, which were carried out by representatives of the Department and of the Society, assisted by neighbouring farmers, eventuated on 6th June at Carr's Creek, and on 19th at Great Marlowe.

Comments.

The Department of Agriculture's Certificate of Merit, and the Clarence P. and A. Society's prize of £5 goes to Mr. A. J. Miller, Ulmarra, and the second of £2 to Mr. H. J. Dix, Carr's Creek. While a difference of nearly 5 bushels separates these two, it is worthy of note that less than a bushel separates Mr. Dix's entry from Mr. Ford's Improved Horsetooth and the Department's Fitzroy.

Messrs. Crispin and W. Paine, on whose farms the trials took place, are to be congratulated upon the whole-hearted manner in which they conducted these tests, and the efficient way in which they looked after the crops.

The support given this first contest on the Clarence by local farmers is encouraging, and it is hoped an endeavour will be made to eclipse the entries on other rivers. From a smaller beginning on the Manning River in 1920, over twenty farmers entered last season—a performance that Clarence farmers might well emulate. Furthermore, in a district such as the Clarence, where the two sowing periods are so well defined, a contest of early varieties sown in August or September as well as one of late varieties might well be made a feature in other years.

The benefit of maize contests can scarcely be over-estimated. Designed primarily to ascertain the highest yielding varieties of maize in a district, the inevitable result is the elimination of low-yielding varieties or strains proved to be so by actual tests under uniform conditions of soil and climate. Thus the average yield per acre of maize in the district is considerably raised, maize growing becomes more profitable, and standardisation of the product on the market results automatically. In view of these facts agricultural societies might well give these contests their whole-hearted support.

WINTER GRASSES FOR THE INVERELL DISTRICT.

THE best winter grasses to grow in the Inverell district are Toowoomba Canary grass (*Phalaris bulbosa*), Tall Oat grass (*Avena elatior*), and Giant Fescue (*Festuca arundinacea*). Rhodes grass is a useful summer grass, but does not make much growth during the winter months. An excellent spring and summer grower is Kikuyu grass, and a clover which is well worth a trial is Subterranean clover, which is an annual that seeds freely and provides excellent feed for all classes of stock. With the exception of the Kikuyu, all the above should be sown in the autumn.—J. N. WHITTET, Agrostologist.

The Conservation of Fodder in New England.*

H. WENHOLZ, B.Sc. (Agr.), Special Agricultural Instructor.

EVERY year this question assumes greater significance, and the time is approaching when the conservation of fodder will of necessity become an established part of farm practice throughout the land. Severe losses of stock by actual death occur during long droughts, but it is open to question whether the national loss is not greater from unthrifty stock and the decreased production due to want of provision of conserved fodder during short, dry spells, by reason of unseasonable frosts, or in cold winters, conditions which happen in some form, more or less, each year in New England. The enormous saving which can be effected by the individual farmer in the latter respect needs to be emphasised and carried into effect before the time will be ripe for any scheme of fodder conservation on a large scale, or, at least, the way to it cannot be clearly opened before the path of the former is blazed.

This paper will not be concerned with any system or policy of fodder conservation so much as the methods and crops which can be recommended to the individual farmer in this section of the country to enable him avoid those material losses which take place on his farm each year. The conservation of fodder has been treated under the headings of hay or straw, silage, and grain, and the New England district, with its great diversity of profitable crops of these three classes, is one which should stand foremost in the State in respect to fodder conservation.

Conserved Fodder Benefits the Pastures.

In such a mixed farming and stock-raising district the question of pasture improvement is also an important one, and it may not be out of place here to indicate how the conservation of fodder may maintain or increase the carrying capacity of the pastures. In a permanent pasture, the most valuable grasses are always those of a perennial character; these perennial grasses store a reserve of food material in the thick roots and underground parts of the plant, that serves to provide the grass with its first growth in the spring. By repeatedly grazing this young growth too heavily in the springtime, the reserve material in the roots becomes diminished and these valuable perennial grasses die out and have their places taken by weeds and less worthy grasses. With conserved fodder in the form of hay or silage to fall back upon, the spring growth of the perennial pasture can be protected until it is well established and until it has served the purpose of storing reserve material in the roots for the following spring growth.

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*Paper read at the Conference of Northern branches of the Agricultural Bureau, held at Glen Innes, September, 1922.

Thus the conservation of fodder on the farm has a marked influence upon the maintenance and improvement of the permanent pasture. By judiciously providing fodder for early spring, and keeping stock at least off the very young growth, the valuable perennial character of the pasture can be preserved, and its carrying capacity throughout the rest of the year increased.

Cereal Hay and Straw.

Oaten hay and straw are the fodders produced in the greatest quantity in the New England district, but the winter just passed found very many farms quite destitute and most farms with nothing like sufficient of that class of fodder to carry the stock through without pinching. True, it was a dry and severe winter, but it may easily occur again.

The deterioration of hay and straw stacks in the open in the New England district is somewhat greater than in the drier wheat districts, so that a good thatching may be generally advisable. With good thatchers becoming yearly more scarce, the necessity for making stacks of good size every year or so becomes more apparent. With the stacks which have depreciated too far to be of any feeding value, the American farmer has largely eliminated the waste by returning the straw to the land by spreading machines specially evolved for the purpose, and the Australian farmer may yet have to ponder whether he can afford to burn his depreciated stacks or adopt a similar practice.

A certain amount of shed accommodation is usually available on every farm for hay, but this is generally not sufficient for more than a moderate supply, and the baling or compression of fodder for better storage is a question that is worth consideration. With railway communication to the coast, there seems little doubt that the New England and the North-west will have a big field to exploit in the sudden birth of a large market for lucerne and cereal hay and chaff, the baling or compression of which may be essential for cheaper freight and for storage to preserve an equilibrium of prices. Owing to the heavy outlay involved in plant for an individual farmer, the baling or compressing of fodder is a business that may well be undertaken as a co-operative effort by branches of the Agricultural Bureau. By compressed fodder is meant wheaten hay or oaten chaff containing a good percentage of grain, with lucerne chaff and a little bran, such as is put up fairly extensively in Victoria for the Eastern trade.

Lucerne and Clover Hay.

With an area by no means equal to that of New England, and with a climate much more severe, the State of Wisconsin in America grows 121,000 acres of lucerne, while the whole of the Northern Tableland of New South Wales has only 4,000 acres under that crop. Similarly, Wisconsin has 2,500,000 acres of clover, while the New England district has probably only a few hundred acres—at any rate, an area not sufficient to include in statistics. Bearing in mind the high feeding value and the soil improving qualities of these leguminous crops, which should be grown on every mixed farm where they are at all possible, it is a striking condemnation of the backwardness of our agriculture in comparison with that of America.

Lucerne, of course, is better adapted to the good soils, but on only moderately fertile soil at Glen Innes Experiment Farm an increase from 1 to 2 tons of hay per annum has been secured by the application of 2 cwt. of superphosphate per acre, extending the possible limit of profitable lucerne growing in New England to an area several hundred times greater than that on which this crop is now attempted.

Red clover can be grown on soil types less fertile than lucerne, and while its culture has been prevented from extending greatly by reason of the high price of seed in recent years, this same fact has not prevented its increase in cold climates in the United States of America, where, to judge by the area under crop in Wisconsin, its value is well known. Our chief trouble is that we have not been sufficiently business-like to determine whether Red clover is not still a profitable crop even with the high price of seed. Some experiments in this connection now in progress at Glen Innes Experiment Farm may yet be epoch-making in the history of New England agriculture. The results of American experience in soil improvement by the inclusion of Red clover in the rotation alone have been little short of astounding, but, in addition, there is the reserve of high-class hay which it produces.

Bokhara clover, though probably more adapted for grazing, is worth mentioning for hay because of its ability to grow and produce more hay than any other clover on poor soil. On the granite soils around Tenterfield, which are not sufficiently fertile for lucerne or Red clover, Bokhara clover has already proved a success. As hay it is somewhat coarse, but the growth of the first year at least may be made into good hay if cut at the right time.

Seeding clover with a nurse crop like oats for hay is highly successful in most years, and is particularly suited to the New England district. This method has the advantage of saving in time a better stand, a cleaner crop, and above all a compulsory start in some form of fodder conservation, crop rotation, and increase in soil fertility.

Maize Stover.

At least one-fourth and sometimes nearly one-third of the total nutrients of the maize plant are in the stalk and leaves, and they are wasted to the extent of several thousands of pounds worth annually. Apart from silage, valuable fodder can be conserved by harvesting the whole maize plant when the grain is in the dough stage and stooking it like wheat or oats, husking the ears later and saving the cured fodder, which is known as stover. The method is well suited to maize districts in the northern part of the State, where the autumn and winter rainfall is not heavy, and particularly suitable for the Northern Tableland, where the winters are severe. The best stover is obtained in those seasons, which, like last autumn and winter, turn out dry, and in such winters this feed is extremely valuable. In seasons when a less satisfactory grade of stover is secured through too much autumn and winter rainfall, the need for such fodder is not so great.

Maize stover has been made satisfactorily for several years at Glen Innes Experiment Farm, so satisfactorily that seed maize and stover have actually been obtained from the same crop. There, a machine is used which husks the cobs and shells the grain, and shreds and elevates the fodder into a stack. Maize stover, if well cured, has a feeding value equal to about three-quarters that of lucerne hay, and dry cows with free access to a stack of maize stover during the winter in a bush paddock, have come through in excellent condition with no other feed or care. On a large area the maize is cut in the dough stage with a maize binder, but with a value on the stover of £2 or £3 per ton, the cost of cutting maize by hand, and stooking for winter feed on small areas will be amply repaid in many seasons on the Northern Tableland.

Other Hay Crops.

Sorghum and Sudan grass are good summer hay crops which belong to the same family and usually succeed better in warmer climates than that of New England. Other annual summer hay crops worth mentioning are cowpeas, and perhaps soybeans. Cowpeas have been successfully grown for hay on poor soils in parts of the New England, and the hay can be fed to all classes of stock. It actually contains less fibre and more protein than lucerne or any other hay crop. Soybean hay has become a standard article of commerce in many States of America, and is grown to the extent of 190,000 acres in that country, mostly under conditions similar to those of New England. Soybeans have greater endurance of dry weather than cowpeas, but are not so good if the soil is poor. It is as emergency hay crops of high feeding value when the best time has passed for sowing oats for hay that cowpeas or soybeans are due for a place on the New England farms. Both these crops are a little more difficult to cure and take a little more time than lucerne or clover hay, but they have the advantage of being less easily spoiled by wet weather during the haying process. They are also valuable in maintaining rather than depleting the nitrogen and humus content of the soil.

Peas and vetches are winter legumes which make excellent hay of high palatability, and are best grown in combination with oats to improve the feeding value of the oaten hay for farm use.

Hay has certain limitations and disadvantages as conserved fodder when compared with silage, and the best results are secured from all classes of stock with a combination of the two. Without a leguminous hay in addition to silage, dairy cows cannot be fed much more than a maintenance ration. Heavy milk production on silage alone, or on silage and oaten hay or straw chaff, must be at the expense of the weight and long continued production of the cow.

Silage.

As conserved fodder, silage has the great advantage over hay that it supplies succulence when it is most needed. It also keeps indefinitely and cannot be sold like hay, which usually happens with this fodder when a tempting price is offered. On the other hand, there is perhaps one disadvantage of silage—that stock fall back very quickly if the supply of silage runs out in the midst of drought. As previously suggested, however, hay and silage should be looked upon as complementary fodders rather than fed alone.

In the United States of America the number of silos in 1920 was estimated at 378,000, in which 29,000,000 tons of silage were stored from 4,000,000 acres of silage crops. In Wisconsin alone there were in the same year 82,000 silos —one on every third farm—and because of this conserved fodder, Wisconsin, with snow on the ground for nearly six months of the year, produces 60 per cent. of the nation's cheese and 20 per cent. of the butter. In New England the plaint is widely heard that the climate is too severe for successful dairying except for a few months of the year.

I have great faith in the New England district, and I am confident that one day it will, with part of the North-west, have the greatest agricultural production value of any equal area in Australia: but this day will not arrive until the country is studded with silos, which can be filled with conserved fodder more cheaply than is possible in any other section of the country. An expensive plant such as a silage cutter and blower and a high horse-power engine is no longer required to fill the silo; the much cheaper chaffcutter and bucket elevator operated by an engine of low horse power, such as is mostly already in use on the farm, is much more satisfactory. Such an outfit also overcomes the difficulty in getting help to fill the silo, and the slower filling generally makes the better silage.

Nor can any valid excuse be made for not conserving fodder as silage without an overhead silo. In the drier districts or in well-drained soils and locations pit silage has been highly successful, while a new and highly efficient method of making stack silage has been lately demonstrated in this State. In addition to its value for dairying, the mixed farmer cannot afford to ignore silage for breeding ewes and fattening lambs. At Coonamble Experiment Farm 1,330 sheep have been fed for seventeen weeks on 211 tons of silage at a cost of ¾d. per head per week.

Crops for Silage.

Maize is one of the best crops for converting into silage. It makes the best quality silage and grows sufficiently well for fodder purposes on all parts of the New England. The question is sometimes raised as to whether the grain can be harvested from the crop and the remaining fodder conserved as silage, or whether this course can be recommended. This practice is only possible in a cool climate such as that of the tablelands, and good silage can only be made from such fodder by an experienced man. With such fodder and with frosted maize the addition of water is often required to make the silage pack well on account of its unusual dryness.

In ordinary maize silage about 60 per cent. of the feeding value is in the ear and about 40 per cent. in the stalk and leaves. A properly conducted feeding test has shown that stover silage (*i.e.*, without the ears) was worth 61 per cent. of the value of whole maize silage. This shows clearly that under most conditions it is far more profitable to "silo" the whole maize plant. Only when the price of maize grain is nearly double its normal value is the practice of making stover silage worth considering.

In the coldest parts of the tablelands, where heavy crops of fodder maize cannot be obtained, sunflowers are coming to the front as a silage crop. They produce a great bulk per acre, and the experience at Glen Innes Experiment Farm with sunflower silage has been that it lacked nothing in palatability and compared favourably in milk producing capacity with maize silage. At Glen Innes during two years sunflowers have made a higher yield of fodder per acre, and it can be expected that in still colder parts of New England sunflowers will out-yield maize as a silage crop far more.

In Canada and in the northernmost States of America, what is known as O.P.V. silage seems to be very largely made. This is a combination of oats, peas, and vetches; and as all these crops thrive on the New England, this combination should be worth consideration as silage, not only because of its heavy bulk, but also because of the high feeding value of the mixture and the probable soil improvement from the inclusion of the leguminous crops.

Grain.

Maize and oats comprise the chief grains which are capable of profitable production in New England, and lend themselves admirably to storage as a fodder reserve for stock. Maize is certainly being recognised by New England farmers in recent years as a more profitable grain crop, as witness the 200 or 300 per cent. increase in areas on the Northern Tableland during the last five or six years. This grain is undoubtedly fitted for safe storage in this climate owing to the almost complete absence of insect pests. The value of maize grain for feeding sheep in times of drought is well known, and the cost of storage facilities here is less than any other part of the State. With a better recognition of the value of the stover, and some better realisation of the ease of storage of the grain, maize is destined to become a much more widely grown crop in New England. It has been demonstrated in recent years that with the choice of the right varieties there is hardly any part of the Tableland that cannot produce maize profitably; but it cannot be too strongly urged that this crop should be grown on the best soil on the farm, and that the uses and importance of maize are so great that the question of soil improvement by systematic methods is one that should be carefully considered by every farmer.

The New England district is particularly fortunate in that the cultivation of oats is so profitable on less fertile soils. New England stands foremost in New South Wales in its average yield per acre of oats. From the standpoint of fodder conservation, which may be taken to have, eventually, a weighty influence on the farm income, the question is due for serious consideration whether the very unequal balance which exists at present in the proportion of oaten hay to grain produced might not better be disturbed to have a greater proportional production of oats for grain and oaten straw. This suggestion is, of course, based on a better provision for storage of the grain by means of tanks, bins, or silos away from the depredations of rodent pests.

The conservation of grain by storage on the farm ranks in importance alongside hay and silage, and should be regarded as an essential supplement to these fodders. Silage and hay may spell security and contentment, but grain in addition may spell wealth; and the conservation of fodder of all three classes, once begun in a district so well adapted to them, will undoubtedly lead the New England to occupy its rightful heritage as the most prosperous agricultural district in the State.

THE EFFECT OF BREEDING IMMATURE ANIMALS.

THE prevalent opinion among practical breeders that the mating of immature and undeveloped animals is an undesirable practice, led F. B. Mumford, of the University of Missouri Agricultural Experiment Station to plan an investigation having for its purpose the determination of the facts and a possible explanation of the observed results. Analysis of records kept over a period of ten years suggested to the investigator the following conclusions :—

1. There is material evidence in this investigation to show that the period of gestation has a tendency to increase the rate of growth in young sows.

2. Immature sows bred at five months of age and twice a year thereafter may be expected to develop into somewhat smaller animals at maturity than would be the case if they were not bred until more nearly mature

3. The diminished size of mature sows bred at an early age has no very important practical significance in the production of swine for market, since the difference in size at maturity between animals bred at a very young age and those bred at a later age is not significant.

4. The period of lactation is apparently a heavy drain on the mother. The records of this investigation seem to show clearly that when a young sow is suckling a large litter of pigs, growth is inhibited.

5. The greatest loss in weight during the lactation period invariably occurs during the first month. In some cases, actual gains in weight during the latter months of the lactation period have been recorded.

Farmers' Experiment Plots.

MAIZE EXPERIMENTS, 1921–22.

South Coast.

R. N. MAKIN, Senior Agricultural Instructor.

DURING the season 1921–22, five maize variety trials for grain and two for green fodder were conducted as farmers' experiment plots on the South Coast. The varieties for grain were tested in co-operation with the following farmers :—

J. Timbs, Albion Park
J. Mison, Milton.
C. T. Hindmarsh, Gerringong.
J. H. Martin, Pambula.
J. R. Knapp, Bolong.

The green fodder trials were carried out by arrangement with :—

H. J. Bate, Tilba Tilba.
Superintendent, Boys' Farm Homes, Mittagong.

A dry winter and spring, followed by very heavy rain, starting in November and continuing until February, were the weather conditions in most of the South Coast districts during the season. At Gerringong 22 inches were registered from November to February, and at Albion Park the record for the same period was 26 inches. The effect of this heavy rain is reflected in the yields from the plots at both these centres, poor setting of the grain, due to bad pollination, resulting; for satisfactory fertilisation the pollen must be dry. At Nowra, where the yields were highly satisfactory, the rainfall totalled 17·58 inches for the same period.

Soil and Sowing.

Nowra, Tilba, Pambula, and Gerringong plots were on alluvial soils, typical of good class maize soil. Those at Albion Park and Milton were on soils derived from basaltic formation, and that at Mittagong on soil of sandstone formation. All plots were sown by means of the maize-planter with manure attachment. For grain about 10 lb. of seed per acre was sown, and for silage or green fodder about 30 lb. per acre. All the grain plots were manured with P7 mixture (superphosphate and bonedust mixed in equal proportions) at the rate of 2 cwt. per acre. In the green fodder section a test with and without manure was carried out, as will be seen in the records.

The Crops.

Germination was good, and the plants made good growth under careful cultivation, though the plot at Milton suffered severely when cobbing through a windstorm, and on this plot also the early-maturing varieties suffered an attack of leaf blight, Early Morn being particularly badly affected.

It cannot be claimed that any one variety proved superior on all the plots; had weather conditions been more favourable at cobbing time there is no doubt that the early varieties would have yielded better.

The Nowra Plot.

The idea, adopted some years ago, of inviting farmers to test varieties of their own growing alongside those of the Department's selection was brought into practice dur[illegible] the past season at Nowra, under the auspices of the Nowra Agri[illegible] Association. Fourteen farmers sent along seed, and the plots w[illegible] on Mr. J. R. Knapp's farm at Bolong. The soil is of alluvial deposi[illegible] olds the moisture well, yet it is well drained. The paddock had been u[illegible] grass for some years. The plot was ploughed early and well worked t[illegible] get the couch grass out, and the seed was sown with the maize-planter on 13th October, 1921, 2 cwt. per acre of P7 mixture being sown at the same time.

Germination was good in all sections except that of E. Wood's variety, which was patchy. Harvesting was carried out in May, and as there appeared to be some variation in the moisture content of the grain of the different varieties, samples from each were carefully selected and subjected to a moisture test by the Brown-Duval tester. The yields as shown in the following table are such as to allow of only 14 per cent. of moisture, anything over that having been deducted.

As far as the farmers' varieties are concerned, the best returns were obtained from J. W. Henry's Boone County White and A. Mottram's Hickory King; these two tied for first place. Among the varieties selected by the Department, Funk's Yellow Dent yielded 149 bus. 44 lb. of good corn and put up a record for the South Coast as far as farmers' experiment plots are concerned. This variety has claimed a host of admirers throughout the South Coast and will be largely grown in future years. An amount of interest was centred in this plot, and it is hoped that there will be more farmers represented in the next test. There is no doubt that such work promotes a keen desire for information on the part of the grower, and enables the Department to get in close touch with farmers.

The Green Fodder Trials.

In the green fodder trials, in which certain artificial manures were tested on the variety Fitzroy, the results at Mittagong again point to the success of superphosphate. At Tilba, superphosphate showed to the best advantage against all others, although, strange to say, the P7 mixture section did not yield as well as that untreated. As the history of the cultivation of the soil in this paddock is not known as well as that of the Mittagong plot the difference cannot be so well accounted for. One feature on both of these plots was the poor germination and poor return, comparatively, from the plots treated with M6 mixture, which contains muriate of potash, and apparently injures the grain when germinating.

RESULTS of Variety Trials.

Variety.	Albion Park.		Milton.		Gerringong.		Pambula.	
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.
Funk's Yellow Dent	51	0	37	0	29	26	66	24
Leaming	54	0	38	0	37	26	74	0
Goldmine	45	22	37	0	24	36	92	32
Silvermine	35	40	23	44	.....		82	40
Manning Silvermine...	36	0	......		......		89	32
Golden Beauty	34	25	48	0	......		92	32
Ulmarra Whitecap	37	0	34	20	28	22	74	0
Manning Pride	35	0	55	39	26	44	93	24
Eureka	30	42	.. ...		......		......	
Pride of Hawkesbury	41	0	31	20	38	0	99	12
Boone County White	43	0	44	0	32	38	62	0
Craig Mitchell	47	33	......		43	22	98	0
Fitzroy	42	26	67	22	46	34	69	0
Yellow Hogan	47	33	31	20	26	44	80	32
Large Red Hogan	56	21	49	31	33	42	96	0
Narrow Red Hogan..	38	0	46	14	......		66	0
Early Morn	......		19	46	23	0	......	
Yellow Mastodon	......		......		33	42	80	0
Yellow Moruya	......		......		......		90	24

RESULTS of Nowra Variety Trials.

Farmer's Name	Variety.	Yield per acre.		Farmer's Name.	Variety	Yield per acre.	
		bus.	lb.			bus.	lb.
Department of Agriculture.	Funk's Yellow Dent...	149	44	H. Knapp ...	Giant White... ...	113	14
	Ulmarra Whitecap ...	98	42	E. Woods ...	White Horsetooth ...	100	48
	Yellow Hogan ...	107	51	P. Daley ...	Hickory King . .	105	41
	Red Hogan	121	31	B. Barren ...	Hickory King ...	109	31
	Fitzroy	105	13	H. Smith ...	Giant White... ...	105	33
J. W. Henry...	Leaming	108	2	A. Mottram ...	Hickory King . .	119	45
W. Ryan ...	Sibley	89	22	J. Watts ...	....	116	3
R. Aberdeen...	Hickory King ...	109	19	E. Mison ...	Giant White... ...	103	3
J. Cluttick ...	Boone County White	109	43	A. Lamond ...	White Horsetooth ...	110	44
J. W. Henry...	Boone County White	119	45	T. Herne ...	Hickory King ...	108	53

RESULTS of Green Fodder Manurial Trials.

Manure per acre.	Yield per acre.				Manure per acre.	Yield per acre			
	Mittagong.		Tilba Tilba.			Mittagong.		Tilba Tilba.	
	t.	c.	t.	c.		t.	c.	t.	c.
1 cwt. superphosphate	15	6	...		2 cwt. P7 Mixture ...	14	2	19	16
2 cwt. " ...	14	15	27	8	2 cwt. P8 " ...	10	14	20	14
No manure	8	11	20	0	2 cwt. M6 " ...	13	11	13	10

Field Experiments with Peanuts.

GRAFTON AND WOLLONGBAR EXPERIMENT FARMS, 1921–22.

VARIETY trials with peanuts were carried out at Grafton and Wollongbar Experiment Farms during the season 1921-22, White Spanish, Valencia, and Chinese in each case being the sorts under trial.

Mr. A. W. S. Moodie, Experimentalist at Grafton Experiment Farm, reports as follows:—

The plots (on red volcanic soil) were situated in a netted paddock, so that as little damage as possible should be sustained from vermin, bandicoots having shown particular ingenuity in attacking this crop. The land was ploughed with the double-furrow disc plough to a depth of 8 inches during August and harrowed down, reploughed with the single-furrow mouldboard plough to a depth of about 7 inches on 19th September, and subsequently harrowed, rolled, and harrowed, this bringing it into fine condition for planting, which took place on 23rd, 24th, and 26th September. The crop was planted in rows 3 feet apart, the seed being dropped by hand 14 inches apart in the rows. The plots of Chinese and Valencia were sown with shelled seed, and those of White Spanish with unshelled. The drills were opened up with the single-furrow plough and the covering done with the strawberry cultivator.

Except where bandicoots had removed a quantity of the seed, germination was very satisfactory, White Spanish germinating slightly the more slowly, but equally successfully. Cultivations were commenced with the single-horse cultivator when the plants were about 6 inches high, the crops being kept free from weeds. Growth, though somewhat slow through the dry weather of November and early December, was satisfactory, but leaf spot was prevalent (especially in White Spanish) during the later stages, the wet weather of February apparently favouring the disease, which in many cases resulted in the tops being entirely killed off. The rainfall was as follows:—October, 229 points; November, 135; December, 689; January, 22; February, 982. Total, 20·57 inches.

Harvesting was commenced on 23rd March, just as the tops were beginning to go off and before any second growth had commenced. The plants were dug with the potato fork, dried in small cocks, and subsequently threshed by hand. White Spanish yielded 1,320 lb. per acre, Chinese 1,183 lb., and Valencia 986 lb.

The red volcanic soil appears to be rather stiff for the best results from this crop, the "pigs" not penetrating it as freely as they would in a sandy soil, even when a small hill is thrown up round the plants. On sandy soil, too, it would be practicable to plough the crop out instead of forking it. Until a machine capable of threshing peanuts is available, threshing must remain the most costly operation in connection with the production of the crop, though beating the plants across a board or rubbing them over a tightly-drawn wire netting, afterwards winnowing to remove trash and unfilled pods, suggest themselves as time-saving devices in this connection.

Mr. J. Douglas, Assistant Experimentalist at Wollongbar Experiment Farm, reports as follows:—

The plots were situated on a section of land not quite so red as that on the rest of the farm, in order that discolouration of the crop might be avoided. The land was in good condition at planting time, having been disc-ploughed on 6th July, disc-harrowed, reploughed on 10th September, and worked to a fine tilth with heavy harrows. Shallow drills were opened up 3 feet apart on 28th September, the nuts being dropped in 7 inches apart and covered by hand. Owing to the dry spring, germination was only fair; Chinese showing up best.

Cultivation was carried out between the rows, and hilling was done by means of two special mouldboards attached to the cultivator, the object being to allow the flower stems to penetrate into the loose soil and also to smother small weeds growing around the plants.

From December the crop showed remarkable growth. March and April were very dry, but the nuts filled out well. The rainfall was as follows:—September, 21 points; October, 198; November, 94; December, 1,226; January, 384; February, 1,939; March, 408; April (to 29th), 24. Total, 42·94 inches.

The plants were ploughed out on 29th April, each one shaken to free the roots of earth, and then placed nuts upward to dry. After a few days in the sun they were gathered into heaps, and when perfectly dry the nuts were removed from the plants in the field by means of a wire-netting apparatus. White Spanish yielded 2,165 lb. per acre, Chinese 1,498 lb., and Valencia 758 lb.

The nuts of White Spanish were small but well filled, with two kernels in each nut. The low yields of Valencia were due to poor germination; the nuts were large, each containing up to four kernels. They appear to have a superior flavour and should be best for commercial use. Chinese also seemed a good commercial nut, containing up to three kernels.

This crop, which seems to make good forage for pigs, and the tops of which make good hay or cow feed, does well on the Richmond River. From a commercial point of view, however, nuts grown on the average red volcanic loam of the district are at a disadvantage, inasmuch that they are usually badly stained. Whether it would pay to transport the product any distance—there is practically no sale locally—is also a question.

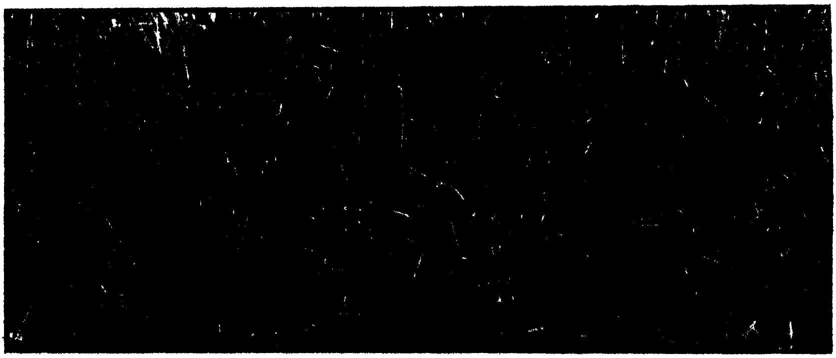
Winter Grasses in the Orange District.

J. N. WHITTET, Agrostologist.

DURING July and August the growth on the natural pastures of the Orange district was very poor, and observations made on plots of grasses and clovers during this period were distinctly in favour of those sown with the intention of providing winter pasturage for stock. The plots under review had been grazed right through the year, and although the season was a dry one a good green shoot was present on some varieties, especially Toowoomba Canary (*Phalaris bulbosa*), Tall Oat (*Avena elatior*), Giant Fescue (*Festuca arundinacea*), and Awnless Brome (*Bromus inermis*).

The plots located on Mr. W. Brown's property, Avondale Dairy, Orange, demonstrated that *Avena elatior* is the first of the winter grasses to move, but is closely followed by *Phalaris bulbosa*. Both these grasses are very palatable, and stock prefer them to all others. *Festuca arundinacea* stands heavy stocking exceedingly well, as the animals do not eat the grass as close to the ground as they do *Phalaris bulbosa* and *Avena elatior*, owing to it being a trifle harsh at the base of the plant.

In a wet season the lower portion of these plots remains damp for a considerable period, due to soakage from the more elevated section of the paddock, and it is interesting to note the prevalence of *Festuca arundinacea* in the wet section, and the fact that *Avena elatior* is practically non-existent. On the drier portion of the area *Avena elatior* is extremely thick.



Toowoomba Canary Grass (*Phalaris bulbosa*).

A seven-year-old stand at Orange, showing a thick winter sole.

A 16-acre pasture of *Phalaris bulbosa* and Cocksfoot (*Dactylis glomerata*) was sown seven years ago on this property, and the area was in extremely good condition in July last. Last season an average of 100 milking cows were turned into this area from 9 a.m. to 12 noon every day for ten months. At the end of this period the grass was getting ahead of the cows; and it was decided to close the paddock and cut the area for hay. At the end of two months the best 10 acres of this paddock were harvested, and yielded approximately 14 tons of good quality hay, the bulk of it being *Phalaris bulbosa.*

A number of clovers have been planted on this property, and Chilian (*Trifolium pratense* var. *perenne*), Ladino (*T. repens* var.), and Shearman's (*T. fragiferum* var.) were giving good results.

Mr. Gordon Henderson, "Strathnoon," Borenore, considers *Avena elatior* and *Bromus inermis* to be two of the best winter grasses in his plots. *Bromus inermis*, however, does not stand the same amount of feeding as *Avena elatior*, but is an extremely palatable grass. *Phalaris bulbosa* is also doing well, and the same may be said of a plot of Prairie grass (*Bromus unioloides*). Although the latter grass does not last as long as the others, it comes away rapidly in the winter and provides good, succulent feed at that period and during the spring months.

"THE STORY OF THE AGRICULTURAL CLUB, 1918–1921."

IN this volume Sir Henry Rew, founder and president of the club that, during a critical period in British history, rendered conspicuous service to primary producers, and hence to the nation generally, provides an inspiring record of its proceedings.

The club, which only existed from early in 1918 to the end of 1921, was limited in its membership to members of the Agricultural Wages Board, District Wages Committees, and a small proportion of interested persons who were specially nominated. This meant that it consisted, in the majority, of landowners, farmers, and farm labourers from all parts of Great Britain, who for the first time in history were given the opportunity of discussing freely and on equal terms the problems confronting those whose object for years past had been to bring about a revival in British agriculture, and to make England self-supporting in the matter of food.

Sir Henry Rew gives an excellent account of the discussions of the club. While the chapters are somewhat disconnected—the book only claims to be a compilation—they do contain a good deal of food for further thought and discussion. Practical farming, agricultural economics, agrarian politics, nationalisation of land, ownership and tenancy, and the worker's share in agriculture, are some of the questions discussed.

An interesting remark is made by one member, discussing agricultural organisation: "It may, in fact, be argued that the factors of climate, weather, and soil count 90 per cent. or more in the price of agricultural produce, the difference between good organisation and bad being only 10 per cent., or less. I do not know how this may be . . . I only know that when agricultural co-operation was started in Ireland, fertilisers came down 50 per cent. When the Irish Agricultural Wholesale Society took to providing dairying machinery, prices dropped 20 per cent."

Our copy from the publishers, P. S. King and Son, Ltd., London.

Pig-raising in New South Wales.

A. F. GRAY, Piggery Instructor, Hawkesbury Agricultural College.

THE backward state of the pig industry of Australia is a condition that we cannot feel at all proud of, but the progress of our wool, grain, beef, mutton, and butter industries should be an incentive to those interested in pig-raising.

The climatic conditions of New South Wales render this State particularly favourable to the production of healthy and well-developed swine, and to the cultivation of the crops requisite for supplementing the natural pastures. It is not surprising then to find that in Australia New South Wales is the leading State in this industry, the number of pigs in New South Wales in 1921, amounting to 306,000, representing approximately 40 per cent. of the total for the Commonwealth of Australia. In spite of this, however, New South Wales does not produce enough pork and bacon to meet the requirements of her own population, and we have to import a good deal of both from the other States.

Not only is there room for development in respect of local requirements, however, but there are considerable opportunities for cultivating oversea markets. Great Britain imports large quantities of pig-products, and the restoration of Australian bacon to the Indian army contract lists should also give a sense of confidence in the development of an export trade.

The marketing of a satisfactory product of even quality, suited to the palate of the oversea consumer, well packed and landed in good condition, will soon command a large export trade, provided a sufficient quantity is produced to ensure a fixed and regular supply.

The pig is not a native of Australia, but representatives of the most important British breeds have been imported from time to time; experiment and experience, however, have shown that only three of these breeds (Berkshire, Middle Yorkshire, and Tamworth) are particularly adapted to our conditions, and have been successfully acclimatised here. In recent years importations have also taken place from America of the Poland-China breed.

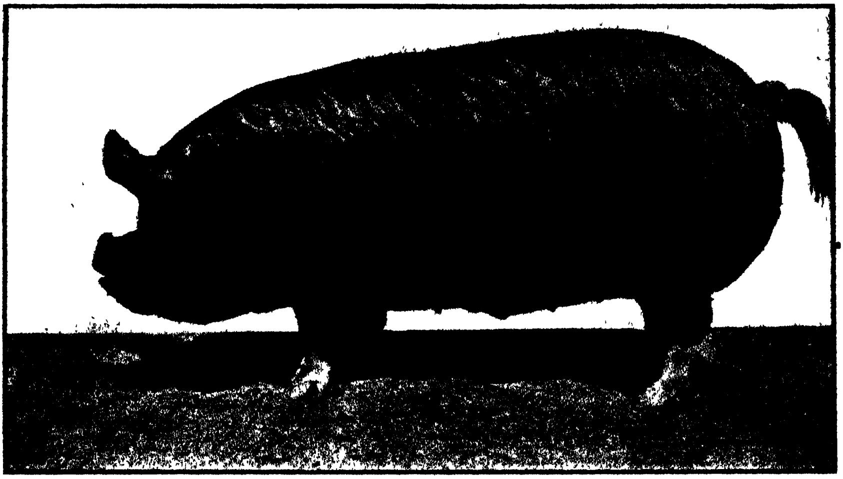
The Breeds.

The *Berkshire*.—This is recognised as the best dual-purpose pig, for use either as a porker or a baconer. It is quick-maturing, hardy, and suitable for most varying climatic conditions, and is, therefore, recommended for general use.

The *Tamworth* is a pig of very strong constitution, and particularly suitable for grazing conditions. The great length and depth of body, and other bacon qualities, make this breed most favoured for cross-breeding purposes to produce an ideal bacon pig. A particularly good cross is with the Berkshire.

The *Middle Yorkshire*, a dual-purpose pig, is a quick maturer, and is used chiefly as a porker. This breed is less hardy than the Berkshire, and to be most profitable it requires fairly good climatic conditions.

The *Poland-China*, an American breed of the lard type, is in favour because of its early maturity, ease of keeping, and suitability for the production of ideal porkers, either as a purebred, or crossed with the Berkshire. Animals of this breed are more particularly adapted to the cooler climates of the State.



Berkshire Sow.

Which of these breeds of pigs should be kept by the farmer, therefore, depends upon the class of product he proposes to raise, and that again will depend upon the class of his country, distance from market or from quick communications, and the feed available.

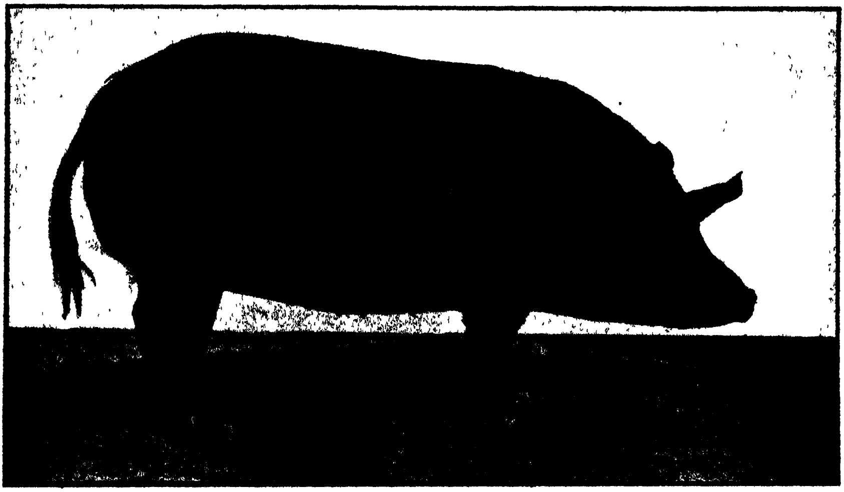
In the vicinity of large centres the pork breeds, *e.g.*, Berkshires, Middle Yorkshires, and Poland-Chinas, are the most suitable, while in the wheat belt, in the coastal areas, and in places where bacon factories are provided, the Berkshire and the Tamworth, or crosses of these breeds, are most profitable.

Different Methods of Pig Raising.

The opportunities for persons desiring to take up this branch of farming may be classified as—(1) the breeding of stores; (2) fattening for pork and bacon; and (3) stud breeding. These present possibilities of building up a lucrative calling, and of helping to develop a much neglected national industry. Natural aptitude, enthusiasm for the work, and a knowledge of the care and habits of the animal are qualities that make for success.

The pig industry has so far developed in this State in conjunction with other branches of agricultural production, and when regarded as a means of increasing the number of ways in which a farm may be made to contribute to the prosperity of its owner, it may safely be said that no farm should be without a few pigs. Those at present engaged in this form of production may be classified thus :—

1. The *mixed farmer*, who principally grows maize, lucerne, fruit, or some such line, and who utilises the pigs to consume portion of the main crop, or, at any rate, to clean up the waste and turn it into a marketable commodity. Some farmers in this class graze the pigs on pasture, and find that with an abundance of sweet and nourishing grasses the animals become healthy, hardy, and vigorous with a minimum of labour.



Tamworth Sow.

2. The *dairy farmer*, who keeps pigs to use up his skim-milk. This is the largest class of pig-raiser in the State, the pig being found a most efficient means for the disposal of the by-products of the dairy.

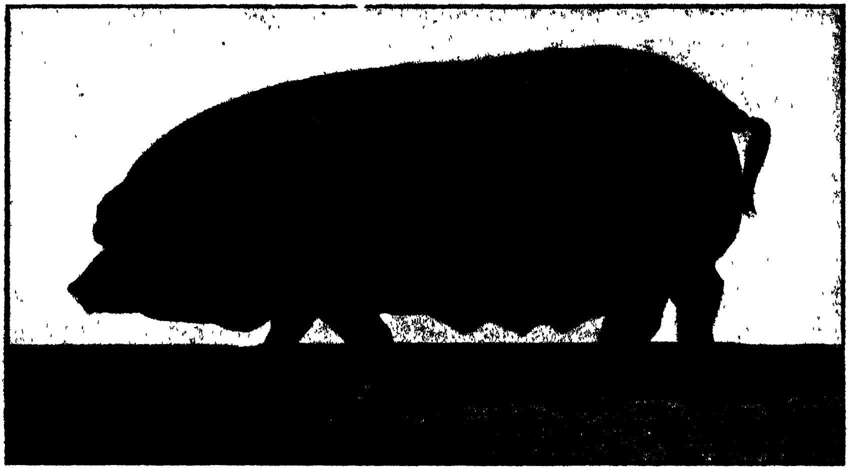
3. The *suburban pig-fattener*, who buys up store pigs and brings them quickly into condition for sale as porkers or baconers, taking advantage of his proximity to cities or large towns where cheap food in the shape of kitchen refuse, &c., is readily obtainable.

4. The *householder*, who fattens one or more pigs annually from the daily refuse of the home, orchard, or garden.

5. The *stud breeder*, who aims at producing the best of stock by careful attention and selection, and distributes throughout the country pedigree pigs of good quality.

There is no doubt concerning the advantages of grazing for pigs, in conjunction with a supply of artificial feeds when necessary. Where available, sweet nourishing grasses are very suitable for growing pigs, building up a good frame, assisting in the development of a hardy, vigorous constitution, and preparing a medium for the production of a rich-flavoured class of meat. An animal bred and grown under such conditions can be readily fattened or topped off with grain or similar feeds.

At the same time grazing cannot be regarded as a complete substitute for grain and other feeds, for in addition to the need for more concentrated feeds when the animal is being finished off for the market, there are inevitably times of the year when the grazing must be supplemented with lucerne, maize, skim-milk, or the like, to say nothing of the value that will often attach to well-grown succulent fodder crops in conjunction with the grasses.



Poland China Sow.

Whatever class of pig-farming is taken up, however, and whatever breed is selected, it is wise to obtain a boar of sound breeding, and to join him with sows that, whether pure-breds or crossbreds, show good type and quality and that have been selected from large, thrifty litters.

The Site for the Piggery.

The site on which the piggery is to be located should lend itself to being effectively drained. It should have a gentle slope, without being steep, and if the aspect is to the east, it will be so much the better in the greater part of the State. The drainage should be of a surface kind, the result of the fall or slope, and should not depend upon underground drains, which are apt to get choked up and can never be kept in the same sanitary condition as those to which the sunlight has access.

If there is a piece of rough ground on the farm that is conveniently situated and otherwise satisfactory it may be very suitable for the piggery. Regard must be had, too, for the position of the residence, for if the prevailing winds carry the smell of the piggery to the dwelling, one or other will probably have to be moved quite soon.

Light, absorbent sandy loams are preferable to stiff clays or soils with a clay subsoil. Clays are apt to become saturated with offensive matter in time, and thus to give rise to unhealthy conditions, especially during wet weather. Where there is a good fall, however, clays are less objectionable.

(To be continued.)

"CYCLOPEDIA OF FARM ANIMALS."

LAST month acknowledgment was made in these pages of receipt of a copy of the "Cyclopedia of Farm Crops" from the publishers, the Macmillan Co. Ltd., New York. We now have before us, from the same publishing house, a companion volume, the "Cyclopedia of Farm Animals," also edited by L. H. Bailey, running into 708 large pages, extensively illustrated. The value of animals as a factor in the profitable occupation of the land has been known to mankind for many generations, but it has required the modern student in agriculture, with his intimate knowledge of the soil and the complex processes that go on therein, to appreciate fully the reasons why grazing and farming associate themselves with such advantage, and to show in what directions that association may be employed to man's maximum advantage.

So intimately are these two methods of production connected that the editor of the volume now before us is led to remark in his preface that "the resourcefulness of an agricultural population depends very largely on the mastery of animals. The effective use and the skilful breeding of animals express one of the main elements in man's dominion over nature." In this country the significance of these remarks is beginning to take hold of many of our producers, and the animal is no longer a more or less accidental occurrence on the farm. The wheat farmer, for instance, is learning that sheep not only offer him direct profits, but become a valuable factor in the maintaining the cropping capacity of his land. On the other hand the dairy farmer, hitherto dependent almost wholly upon pasture, is learning that fodder crops increase his milk flow and serve to preserve the carrying capacity of his land. Thus live stock are coming to have a new significance, and the relationship of cropping and grazing promise to become closer still and withal more intellingently controlled.

Under these circumstances the literature of animal husbandry is becoming very abundant, but the volume before us may be commended as particularly comprehensive. It discusses the breeding, feeding, exhibiting, and management of animals, the marketing of live stock, and the manufacture of their products; and then devotes over 400 pages to the discussion of some thirty of the animals and birds of American farming practice—horses and cattle occupying some eighty pages; poultry, sheep, and swine rather smaller sections; and bees, dogs, fish, goats, and so forth, each a few pages.

As with the previous volume, the illustrations are very numerous, many of the plans of buildings, parts of machinery, graphs, and drawings being excellently produced.

Our copy from the publishers, The MacMillan Company, Ltd., New York.

Staggers or Shivers in Live Stock.

[Continued from page 724.]

SYDNEY DODD, D.V.Sc., F.R.C.V.S., Lecturer in Veterinary Pathology and Bacteriology, University of Sydney, and MAX HENRY B.V.Sc., M.R.C.V.S., Government Veterinary Surgeon, New South Wales.

Experiment No. 5.—*To determine whether Staggers can again be induced in lambs that have apparently recovered from the disease.*

Two ewes and lambs, the latter known to have been previously affected and apparently recovered (*vide* p. 655, Everson, owner), were brought to an affected locality by lorry and placed in a small pen, together with another ewe and lamb known never to have suffered from staggers. They soon ate down the small amount of herbage growing in the pen, and their subsequent diet was exclusively mallow.

On the fifth day, up to which time a total weight of 218 lb. of fresh-cut mallow had been consumed, the animals were tested by driving for 2 miles. For some distance nothing abnormal was observed; then one lamb collapsed rather suddenly, and, later on, when moving, did so with a stiff gait and slight trembling of its limbs. The second lamb, which was weak and poor in condition, collapsed later. The third lamb (which had not previously been affected), showed some symptoms, but not until the drive had been completed. The ewes remained normal. All were driven at a moderate pace, and any healthy lamb would not have been inconvenienced by the journey, whereas, in this instance, the oldest and apparently the strongest lamb collapsed first.

On the sixth day the animals were again tested by driving, and all three lambs developed staggers before travelling three-quarters of a mile. It may be suggested that the two previously affected lambs had not recovered from their first attack, but had merely suffered from a relapse. The history of the animals being known to the authors, it is considered that the above results were due to an independent attack and not to a relapse. It was noted that the lambs did not suffer as severely as in the grazing experiment (Experiment No. 1).

Experiment No. 6.—*To ascertain whether sheep fed in a river paddock, exactly similar to that in which the grazing experiment (Experiment No. 1) was performed, would contract the disease after all the mallow had been removed.*

Portion of a lucerne flat, which adjoined the alluvial paddock utilised in the grazing experiment (Experiment No. 1), and in which the soil was exactly similar, was placed at our disposal. In it was growing a fair crop of lucerne, together with a good proportion of crowfoot, trefoil, mallow, shepherd's purse, dock, and other plants. An area of about 1½ acres was fenced off and all the mallow from this enclosure pulled out by hand. Six ewes with lambs from a hilly, staggers-free locality were placed in this enclosure together with seven ewes with lambs ("C" sheep, used in Experiment No. 1), six of these latter lambs having been affected as the result of the previous experiment. From observation, it was concluded that some of these "C" lambs, which, with their mothers, had remained in the paddock used for Experiment No. 1, would show symptoms of staggers if driven. As a matter of fact, although the lucerne paddock used for the experiment now being described was only about a hundred yards distant, one lamb was showing pronounced symptoms of staggers before it reached its destination.

On 21st August, four days after being placed in the enclosure, all the animals were driven 2 miles in fifty minutes without any signs of exhaustion or staggers, and on 30th August, the animals having greatly improved in condition, they were again driven 2¼ miles at a fast pace without showing any abnormality.

The paddock was again searched, and all the young mallow found springing up was removed by hand. It is not possible to say that these sheep obtained absolutely no mallow at all, as the herbage might have concealed some shoots here and there; but one can, at least, say that they obtained very little indeed.

On 14th September the sheep were again tested by driving, but all remained normal.

Remarks.—This experiment showed that the soil itself had no direct influence in the production of staggers, and that the herbage other than mallow was innocuous.

Experiment No 7.—*To ascertain whether short, young mallow, pulled up by the roots, and fed in a fresh, green state, or long, well-grown, cut mallow, also fed green, is the more toxic.*

On 28th August, 1920, eight ewes, all with lambs, were brought by lorry from a staggers-free area and placed in the paddock used in the grazing experiment (No. 1). Two enclosures were made in this paddock, and all the vegetation and the top layer of soil removed therefrom. Four ewes with lambs were placed in No. 1 pen, and these were fed on young mallow pulled up by the roots. The same number of ewes and lambs were placed in No. 2 pen and fed on green, well-grown mallow cut with a sickle. The long mallow was affected in patches with rust (*Puccinia malvacearum*).

The feeding was conducted for fourteen days, the total amounts consumed being 167 lb. and 144 lb. in No. 1 and No. 2 pens respectively. On 30th August (second day) both pens of animals were tested by driving along a road, but only one lamb (from No. 1 pen), developed definite symptoms of staggers.

On 14th September (sixteenth day) all the animals were again driven about 4 miles in 1 hour 50 minutes, with the result that two lambs from No. 1 pen, and one from No. 2 pen, showed symptoms of the disease. The other animals remained normal. This experiment was not persisted with.

Remarks.—Apparently from the foregoing experiment it would appear that young mallow is more toxic than well-developed mallow when both are fed in the green state, but the number of animals used and the length of the experiment hardly justifies one drawing any definite conclusion on this point. On the other hand, as will be seen in the following experiment. well-grown mallow was found to produce staggers in adult sheep, whereas young mallow was innocuous.

As to the question whether staggers can be produced by *Malva parviflora* in districts where it has not been recorded, feeding experiments narrated under Experiment No. 2 (p. 7 9) appear to answer in the affirmative.

It must, however, be pointed out that in the latter case, mallow is not the main constituent of the animals' diet, but rather a minor one. Whereas in staggers country, at certain times of the year, it constitutes a very great proportion. The above does not refer to feeding experiments in a staggers-free district with mallow from a staggers area, which has been dealt with in Experiment No. 4.

A small experiment was conducted to ascertain the toxicity of the seeds. A sheep from a staggers-free area was fed on a daily ration of 1½ lb. mallow seeds, and no other feed, for six days. On the fifth day it was driven 4 miles, the animal remaining normal. On the sixth day it was again driven, and after travelling a mile the gait became stiff and cramped, the pace became slow, hocks not flexed, back arched, head depressed, toes dragging. The sheep was stopped in the shade trembling violently, the whole body being affected, although most noticeable at the croup, thigh and flank. The respirations were hurried and shallow. A control sheep remained normal.

In consequence of the fact that the experiments previously related had succeeded in producing staggers in the lambs only and not in adult sheep, it was decided to carry out a further series of experiments. Accordingly, paddocks on a farm where staggers was very prevalent were loaned to us, pens were erected, and sheep from a staggers-free area purchased for the work. The experiments were carried out by Mr. W. L. Hindmarsh, B.V.Sc., under the direction of the authors.

The experiments were very extensive, but as the details contain a good deal of repetition it is thought sufficient to give a synopsis of them.

In all these experiments the sheep were muzzled while being driven, in order to prevent them eating anything they were not intended to.

Experiment No. 8—*To produce Staggers in adult sheep.*

Four adult Border-Leicester wethers were placed in a pen and fed on well-grown mallow, 4 to 5 feet high, cut from a paddock with a bad reputation for staggers. In fourteen days the four sheep consumed 286 lb. of mallow. On the fourth day of feeding the animals were tested by driving. After about 2½ miles one sheep developed symptoms of the disease, walking with a stiff gait, hocks not flexed, back well arched, respirations 60, temperature 102 degrees Fah. No further symptoms were noted.

On the tenth day the animals were again driven, when the same animal developed the same symptoms, only in a more pronounced degree, and when allowed to stop at the conclusion of the journey both fore and hind limbs trembled violently. Temperature 104 degrees Fah., respiration 80, pulse 120. The animal recovered in four minutes and then proceeded normally.

On the eleventh day, on being driven about a quarter of a mile, the same sheep began to exhibit characteristic symptoms. It collapsed at one and a quarter miles. Temperature 105·4 degrees Fah., respiration 100, heart rapid and irregular; the whole body trembled violently before the animal dropped. After ten minutes rest the sheep arose and travelled normally. During the two-mile drive it urinated on three occasions. During the same drive a second sheep showed similar symptoms, but to a less degree, trembling for two minutes when stopped at the end of the journey.

This experiment was controlled by a pen of sheep fed on herbage other than mallow from the same paddock. They were driven the same distance, but all remained normal. The herbage fed to these latter consisted of trefoil (*Medicago denticulata*), crowfoot (*Erodium cicutarium*), variegated thistle (*Silybum marinum*), and shepherd's purse (*Capsella bursa-pastoris*).

A further experiment was carried out in order to ascertain whether the mallow in the flowering stage alone would produce the complaint, but the plant soon passed into the seeding stage and consequently the experiment was in that respect incomplete. In this case four adult Border-Leicester wethers ate 176 lb. of cut mallow in ten days. On the ninth day slight symptoms of staggers were observed in one sheep.

On the next day (the tenth) this animal which, with the others, was being tested by driving, had hardly gone 200 yards when it was observed to be walking stiffly, with back arched and head depressed. It travelled slowly for about a mile, and then lay down, the fore arms, flanks and thighs trembling markedly. The attack lasted about two minutes. Before reaching the pen this animal dropped four times, in addition to the one already described. The distance of the drive was about 4 miles. Temperature 105·6 degrees Fah., pulse 130, respiration 66, mucous membranes injected. A second sheep travelled 2 miles and then began to lag behind the others. Its gait was stiff, and it attempted to lie down. No trembling was noticed.

Regarding this experiment, the particular point in question was not settled, but confirmatory evidence that the complaint was caused by the ingestion of mallow was obtained.

Another grazing experiment was undertaken in which thirty-eight adult sheep were grazed in a paddock from which the mallow for this new series of experiments was obtained. Although the animals were tested by driving on several occasions, no symptoms were observed. As an explanation of the failure of this experiment to produce staggers, it should be noted that there was a very abundant supply of herbage other than mallow in the paddock, and there is every reason to say that the sheep consumed very little of the mallow.

The riding horse used by Mr. Hindmarsh during these latter experiments became naturally affected with staggers during the course of the work. The following are the symptoms noted by him :—

Attacks occur during work; the animal's action is stiff and uncertain; there is trembling or quivering of groups of muscles (particular groups not stated); pulse and respirations are increased; temperature a little raised; there is a general impression of fatigue; urine not observed. In some instances horses have recovered without treatment or change of pasture.

Supposed Staggers in Cattle.—This occurred in young cattle feeding in paddocks containing an abundance of mallow and adjoining that from which the mallow for which the experiments with adult sheep (Experiment No. 8) was obtained. The animals had been yarded overnight, and when released and driven the next morning are said to have shown the typical symptoms of staggers as shown in sheep. They were not seen by Mr. Hindmarsh, but reports from other stockowners bear out the contention that cattle do become affected.

(*To be continued.*)

WHEN STORING ANIMAL MANURE.

WHAT are the best methods of preventing nitrogen losses from stored animal manure? According to the summary of results of investigations carried out by N. V. Joshi, of the Imperial Department of Agriculture in India :—

1. The losses of nitrogen from cattle dung, when stored separately, are small under both ærobic or anærobic conditions of storage.

2. In the case of urine great amounts of nitrogen are lost under ærobic conditions, while under anærobic conditions the losses are negligible.

3. Covering the surface of the urine with a layer of some kind of oil such as kerosene, mustard, or coconut, brings about the necessary anærobic conditions, and this method has proved effective in preventing losses of nitrogen from the urine

4. Among several substances tried to prevent losses of nitrogen from urine occurring under ærobic conditions of storage, sulphuric acid, superphosphate, and formalin have proved effective, but their cost is expected to be prohibitive in practice.

5. Very great losses of nitrogen have been observed when straw and soil were used as absorbents for urine. These absorbents would, therefore, not prove of value in conserving the nitrogen of the urine.

6. Since greater losses of nitrogen occur in the mixture of cattle dung and urine, it is advisable to store cattle dung and urine in separate pits instead of following the prevalent practice of mixing them in storage.

Investigations in Regard to Alkaline Flavour in Butter.

H. D. BARLOW, Dairy Instructor.

AN investigation bearing on the possibility of butter of good flavour and keeping qualities being manufactured from cream which has been neutralised below the accepted standard was suggested on account of the fact that several lots of butter were noticed to have a distinct flavour like soda or other neutralising agent, which had been attributed to over-neutralisation.

Reference to the literature on this subject did not throw any light on the question, and it was decided by the Department of Agriculture to conduct certain experiments, with a view to obtaining information on the following points :—

(*a*) How much the cream would have to be neutralised below the accepted standard to give this flavour.

(*b*) Whether this flavour was caused by over-neutralising or by faulty neutralising.

(*c*) Whether the effect of over-neutralisation on the resultant butter would cause a further deterioration on keeping, or whether the chemical action which takes place is instantaneous and final, and does not have any futher deleterious effect on the butter.

(*d*) What indicators, if any, could be relied on to ascertain the acidity or alkalinity of butter made from neutralised or partially neutralised cream.

Since the accepted standard of neutralisation is in the vicinity of ·2 per cent. to ·3 per cent. acid, it was decided to manufacture samples from cream with a neutralised acidity of ·2 per cent. ·15, ·1 and ·05 per cent. acid, also ·05, ·1 and ·2 per cent. alkaline.

As the action of the neutralising agent is chemical, and to a certain extent mechanical, it is taken for granted that the effect on the butter, whether in a large or small bulk, would be approximately the same, the only difference being that with small amounts the mixing might, though not necessarily, be more complete.

As being the smallest bulk which could be satisfactorily handled to approximate to factory conditions, 20 lb. of cream were taken.

In manufacturing a small box churn and table worker were used, and all operations were carried on in a manner as similar to those followed in factory practice as is possible with such small amounts.

To obtain an absolute comparision of the respective keeping qualities of butter made from cream to which varying amounts of neutraliser had been added, it was essential that the original creams should be as nearly as possible identical, both in composition and bacterial count, as both these factors might have a big effect on the life of the butter.

TABLE A.—Showing results of grading.

Sample	Flavour.	Pts. Flavour.	Butter-fat.	Original Acid.	Theoretical Acid after Neutralising.	Amount of Soda ($Na\ HCO_3$) added.	Temp. Heated to.	Time Held.	Temp. Cooled to.	Time Held before Churning.	Churning Temp.	Remarks *re* Grain.	Amount of Salt.	Amount of Butter.	Preservative.	Remarks.
			%	%	%	grms.	Fah.	mins.	Fah.		Fah.		oz.	lb. oz.		
A	Choice	43	50	·38	·05	27·94	145 deg.	30	50 deg.	Overnight	48 deg.	Small, even.	5	12 9	Nil.	Condition good. Samples A and B had slight soda flavour when churned.
B	,,	,,	,,	,,	·1	23·71	,,	,,	,,	,,	47 ,,	Slightly small.	5	12 9	,,	Condition good.
C	,,	,,	,,	,,	·15	19·47	,,	,,	,,	5½ hours.	46 ,,	Small.	5	12 6½	,,	Condition good. Samples C and D had no soda flavour.
D	,,	,,	,,	,,	·2	15·24	,,	,,	,,	4½ ,,	47 ,,	Small, irregular.	5	11 14	,,	Condition good.
M	,,	43	46	·45	·05	33·86	,,	,,	54 deg.	5 ,,	49 ,,	Soft.	5	11 4	,,	Weak body, free moisture.
N	,,	,,	,,	,,	Alkaline ·05	42·33	,,	,,	,,	Overnight	50 ,,	Good.	5	11 4	,,	Condition good. All samples had soda flavour when churned, and this flavour seemed to develop when sample allowed to stand 2 to 3 hours.
O	,,	,,	,,	,,	Alkaline ·1	46·56	,,	,,	,,	,,	52 ,,	,,	5	11 4	,,	
P	,,	,,	,,	,,	Alkaline ·2	55·03	,,	,,	,,	,,	54 ,,	,,	5	11 4	,,	
E	Over-ripe and tallowy inclination.	40	40	·54	·25	24·97	,,	,,	,,	,,	48 ,,	,,	4½	10 4	,,	Condition good. Butter had distinct tallowy inclination
F		,,	,,	,,	·3	20·74	,,	,,	,,	,,	49 ,,	Good, soft.	4½	9 12	,,	
G		,,	,,	,,	·4	12·27	,,	,,	,,	,,	48 ,,	Good.	4½	10 4	,,	
H		,,	,,	,,	·5	3·81	,,	,,	,,	5 hours.	47 ,,	Small.	4½	9 12	,,	

As the plant would not permit of more than four lots being handled in one day, it was decided to divide the manufacturing into two groups, one group to be acid and the other alkaline, the check samples in each case to have the same amount of acid.

In accordance with this plan, 80 lb. of cream were obtained and thoroughly mixed and then divided into four equal parts, and, except for the different amounts of neutraliser used, each lot was treated in exactly the same manner. With such small lots of cream it was impossible to use any commercial pasteuriser, and each lot was therefore treated by placing buckets in a hot-water vat, stirred continually, and held at the required temperature of 145 deg. Fah. for 30 minutes. The cream was then cooled by being passed over an ordinary small pipe cooler.

Full particulars of manufacture, &c., are shown in Table A on page 808.

In all cases commercial bicarbonate of soda ($Na\ HCO_3$) was used as the neutralising agent, and no preservative was added. The quantities of soda necessary were carefully computed from acidity determinations of the cream, and carefully weighed on a chemical balance.

The samples when made were boxed in approximately 10 lb. boxes, made from ordinary butter-box timber, and papered in the usual manner.

On arrival at Sydney the butter was submitted to the State grader for examination and grading, then put in cold store for about six weeks and again graded.

The results of the grading and remarks of the grader are shown in the table headed "Grader's Report" on page 810.

A sample of each butter was also sent to the Chemist's Branch, Department of Agriculture, for acidity tests, and in connection with this examination, four samples—E, F, G, H—were made from cream pasteurised with an acidity as high as ·5 per cent. Although this cream deteriorated considerably during acid development, and the original flavour was not good, the manufacturing and grading results are considered worth recording.

From an examination of the grading results of samples A, B, C, D, it will be noted that A and C have improved slightly during storage, and samples B and D are quite as good as when made.

As none of these samples had any preservative added, it appears possible if the cream is carefully treated, to make a butter of choice flavour, even if such cream is brought almost to the neutral point, which will neither give any indication of over-neutralisation nor deterioration in quality, when stored for a considerable time.

Samples M, N, O, P, did not turn out quite as well as the cream indicated, but in this group also the butter held its flavour during storage; M and N, if anything, improved; P only very slightly deteriorated.

All these samples had a slight neutraliser flavour when first graded, but this flavour did not increase during storage, only appearing on the second grading as a very slight taint which would not be recognised by an untrained palate.

It would appear from these results that it is possible to have cream of the alkalinity indicated in N, O, P, and still make a butter of good keeping quality, provided the processes of neutralising, pasteurising, and subsequent manufacture are carefully carried out.

Although this experiment is by no means complete, it seems to stress the fact that, provided the neutralising and pasteurising are done carefully, even if a slight error in calculating the amount of acid should occur, the result need not be fatal to the butter.

Since it is generally held that a neutralised acidity of about ·2 per cent. and ·3 per cent. of acid in the cream will give the best results, it is advisable to work within these limits, but too much care cannot be taken in estimating the correct amount of neutralising agent, and adding it correctly.

GRADER'S REPORT.

First Grading.

Sample.	Flavour.	Texture	Condition.	Total.	Remarks.	Date made.	Date graded
						1922.	1922.
A	43	30	20	93	Flat; no flavour of neutraliser noted.	22 March.	30 March.
B	43	30	20	93	Common choice.	22 ,,	30 ,,
C	43	30	20	93	Common choice, slight mottle showing.	21 ,,	30 ,,
D	43	30	20	93	,, ,, ,,	21 ,,	30 ,,
M	41	30	20	91	Distinct flavour of neutraliser and tallowy inclination.	6 April.	19 April.
N	41	30	20	91	Distinct flavour of neutraliser and tallowy inclination.	7 ,,	19 ,,
O	42	30	20	92	Distinct flavour of neutraliser.	7 ,,	19 ,,
P	42	30	20	92	,, ,, ,,	7 ,,	19 ,,
E	39	30	20	89	Tallowy and unclean after-flavour.	23 March.	30 March.
F	38	30	20	88	,, ,, ,,	23 ,,	30 ,,
G	36	30	20	86	Unclean.	22 ,,	30 ,,
H	36	30	20	86	Unclean and oily.	22 ,,	30 ,,

Second Grading.

Sample.	Flavour.	Texture.	Condition.	Total.	Remarks.	Date made.	Date graded.
						1922.	1922.
A	+43	30	20	93	Distinct "choicest butter," and had, if anything, improved slightly.	22 March.	6 May.
B	−43	30	20	93	Common choice middle flavour was "flat," but it was otherwise clean flavoured.	22 ,,	6 ,,
C	+43	30	20	93	Distinct "choicest" very similar to A, and had, if anything, improved slightly.	21 ,,	6 ,,
D	−43	30	20	93	Common choicest, similar to B.	21 ,,	6 ,,
M	−42	30	20	92	Slight soda flavour, and slight tallowy inclination.	6 April.	22 ,,
N	−42	30	20	92	Slight soda flavour and tallowy inclination.	7 ,,	22 ,,
O	+42	30	20	92	Slight soda flavour.	7 ,,	22 ,,
P	−42	30	20	92	Slight soda flavour, and slight tallowy inclination.	7 ,,	22 ,,
E	37	30	20	87	Unclean and tallowy.	23 March	6 ,,
F	36	30	20	86	,, ,,	23 ,,	6 ,,
G	36	30	20	86	Unclean and oily.	22 ,,	6 ,,
H	35	30	20	85	Oily, strong fishy tendency.	22 ,,	6 ,,

It is more than likely that much of the neutraliser flavour noted in butter is caused by the practice of "dumping" the neutraliser into the cream, and not distributing it thoroughly. Consideration of the chemical action which takes place will make this more readily understood.

If a large bulk of alkali is dumped into cream, it immediately combines with all the acid it comes in contact with, and also with the proteid matter in the cream, producing with the latter definite chemical action resulting in partial decomposition of the protein. When stirred the excess alkali is more evenly distributed and combines with the remainder of the acid, but the decomposition products, at first produced by the action on the proteid matter, will still remain, and are very likely to affect the flavour of the cream.

From observation, better results would be obtained from neutralising and pasteurising if these processes were not so open to abuse, but as good results are unfortunately sometimes obtained when no trouble is taken, some operators seem to be of the opinion that no special care is necessary, and this is probably the cause of a large percentage of the process faults noted in butter.

Summary.

(*a*) Butter made from cream neutralised as low as ·2 per cent. alkaline had no objectionable alkaline flavour, and was graded at 92 points.

(*b*) Cream used in making butter in (*a*) was carefully neutralised. It is considered that objectionable alkaline flavours are due to faulty neutralisation processes.

(*c*) The result arising from adding an excess amount of soda was at once apparent in the flavour of the cream; this flavour reappeared in the resultant butter, but diminished slightly during the storage of same.

(*d*) That the four indicators used (litmus, methyl orange, lacmoid, and phenolphthalein) all failed to give satisfaction, the results being complicated by the different effects produced by (1) the phosphates present; (2) the lactic acid present.

The chemical figures obtained by Mr. A. A. Ramsay in connection with the examination of the butters mentioned in the foregoing paper are appended.

Reaction of the Aqueous Extract towards Litmus, &c.*

In examining the reaction towards various indicators of the samples of butter submitted, viz., A to P, the method adopted was to extract 100 grams of the butter with successive small aliquots of water in a separating funnel till the volume of the extract approximated 200 c.c. This was divided into four equal quantities of 50 c.c., each representing 25 grams butter, and each was titrated, using one of the four indicators (litmus, methyl orange, lacmoid, and phenolphthalein). The figures thus obtained represent the action of the various inorganic and organic salts present, plus that resulting from any lactic acid present.

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* A. A. Ramsay, Principal Assistant Chemist.

It was thought desirable to attempt to remove the disturbing influence of lactic acid. The fat was therefore dissolved in ether, which would also dissolve lactic acid, and the fat-ether mixture was extracted with water as described above, and the united extracts made up to 200 c.c., as formerly, and aliquots titrated. The results so obtained are given in the table attached.

The ether solution of the fat was then warmed to volatilise the ether, and the resultant fat, which should also contain the lactic acid, was extracted with water and the amount of lactic acid present thus dissolved was determined.

The remaining fat was finally titrated in alcoholic solution for any free fatty acid. The results are also added to the table given.

It will be noted from reference to the attached table, which represents the result of the examination of the reaction of the aqueous extract of the various butters made towards certain indicators, that towards litmus these are all alkaline from the butters marked A, B, C, D, E, F, *i.e.*, those made from creams of from ·05 to ·3 per cent. acidity. The butters marked G and H, made from cream of a higher acidity, viz., ·4 and ·5 per cent., give an aqueous extract which reacts acid towards the indicator mentioned.

The reaction of every extract towards methyl orange as indicator is always alkaline.

Towards lacmoid as indicator, the reaction of the aqueous extracts is also alkaline up to that of butter marked G, from cream of ·4 per cent. acidity. In the case of butter marked H, for cream of ·5 per cent. acidity, the reaction is, however, acid.

Towards phenolphthalein as indicator, the reaction of the extracts is acid with the exception of that of butter marked A, representing butter made from cream of ·05 per cent. acidity, which appears to be faintly alkaline, and of that from ·1 per cent. acid cream, which is neutral in reaction.

Remarks on the Results obtained.

In A, as the salts present react alkaline towards the indicators used, the compounds present would most probably exist as diphosphates of Na, K, and Ca, also lactates of these bases. These as well as diphosphates react alkaline to methyl orange.

B is in the transition stage.

As regards C, monophosphates appear to show their effect at the stages C, D, E, F, G, since these are fairly strongly acid to phenolphthalein. In the main they appear to increase in amount with increasing acidity of the cream; but not absolutely so, D and E being slightly less than C.

The increase is better shown when the distributing influence of lactic acid is removed.

D, E, F are much like C.

The salts in solution in G react acid towards litmus as well as phenolphthalein. The presence of monophosphates would explain this. The acidity

TABLE B.—Showing Reaction to certain Indicators of certain Experimental Butters.

	First Series.								Second Series.			
	A ·05 acid.	B ·10 acid.	C 15 acid.	D ·20 acid.	E ·25 acid	F 3.	G ·4.	H ·5.	M ·05 acid.	N 05 alk.	O ·1 alk.	P ·2 alk
Aqueous extract obtained by treating the melted butter with water.												
Litmus	*5·18	*4·40	*4·40	*4·78	*4 78	*3·60	0·80	1 20	*4 78	*7 97	*6·57	*6·37
Methyl orange	*6.65	*5·56	*5·16	*5·58	*5·58	*6·37	*4·38	*4·18	*7·17	*9·16	*8·37	*8·17
Lacmoid	*5·98	*5·20	*4·80	*4·38	*3·98	*4·78	*2·78	0·80	*4·78	*6·57	*7·17	*6·37
Phenolphthalein	*·40	Neutral.	1·20	0·60	1·00	1 20	2 00	2·40	0 60	*0·60	*0·40	*0·40
Aqueous extract obtained by first dissolving fat in ether, subsequently extracting the ethereal solution with water.												
Litmus	*5·98	*4·80	*4·40	*5·18	*4·38	*4 18	0·80	1·20	*2·59	*7·57	*6·37	*6·37
Methyl orange	*6·65	*5·96	*6·36	*5·58	*5·98	*7·17	*4·98	*3 98	*2·39	*8·36	*8·37	*8·37
Lacmoid	*6·18	*5·96	*4 80	*4·78	*5·48	*4·38	*2·39	0·80	*1·59	*5·98	*7·97	*6·37
Phenolphthalein	Neutral	*·80	0 60	1·20	1·20	2 40	2·20	2·40	0·40	*0·24	Neutral.	Neutral.
Lactic Acid from ether-solution of fat and acid, first removing ether and then extracting with water	·05	·20	·25	·10	·10	20	·20	·55	·10	·10	·20	·18
Free fatty acid	3·4	3 3	4·5	4·8	4 3	5·5	6·6	9·8	4·9	3·2	3·4	3·20

With the exception of figures for lactic acid, which represent percentage of this present, the figures without stars indicate c c's $\frac{N}{10}$ alkali required to neutralise aqueous extract from 100 grams. butter. Figures with stars indicate c c's $\frac{N}{10}$ acid required.

towards litmus is much smaller than towards phenolphthalein, because monophosphates are much more acid towards the latter (roughly eleven to twelve times).

H resembles G. In G and H the methyl orange figures are smaller because monophosphates exert a much smaller acid effect on this indicator than do the diphosphates an alkaline (roughly 1 mon., 17 di).

In the second series marked M, N, O, P, the reaction of extracts towards all the indicators is always alkaline, with the exception of M, which is faintly acid towards phenolphthalein.

The compounds in these four therefore appear to exist chiefly as diphosphates and lactates.

It might here be stated that normally the alkaline salts in fresh milk are diphosphates and citrates of K, Na, Ca, and Mg. When milk sours, the lactic acid produced reacts with basic salts to form acid salts or monophosphates, citrates, and lactates.

This reaction in which the di-compounds are changed to mono-compounds is a reversible one.

$$\underset{\text{calcium phosphate.}}{2\,\mathrm{Ca\,H\,PO_4}} + \underset{\text{lactic acid.}}{2\,\mathrm{H\,C_3H_6O_3}} \rightleftarrows \underset{\text{calcium lactate.}}{\mathrm{Ca\,(C_3H_5O_3)\,2}} + \underset{\text{mono-calcium phosphate.}}{\mathrm{Ca\,H_4P_2O_8}}$$

It follows that in sour cream or cream of a certain percentage of lactic acid there exists a condition of salts which will be changed if all or portion of the lactic acid be removed by neutralisation.

As butter manufactured from cream must contain some of these milk-salts derived from the cream, it also follows that the condition of these milk-salts will differ according to the phase existing, and that the condition of the milk-salts in butter from neutralised cream will differ from that of the milk-salts in butter made from normal cream.

THE DAIRY COW'S NERVOUS SYSTEM.

ANOTHER quality we are looking for in a dairy cow is a strong, highly-developed nervous system, as such an animal is able to perform more labour beyond what would be expected from appearances. Such a cow will have a large, intelligent eye and a broad forehead, showing well-developed brains controlling the nerves, and a strong, straight spinal cord. The spinal cord runs through the vertebræ from the head to the tail, and sends out from each vertebra branches that connect with the various organs of the body. Now, when the vertebræ are well apart and the back is straight, it shows that the animal has a strong spinal cord, and is an indication of strong nerves.—C. VAN FOREEST, in the *Journal of the Department of Agriculture*, Union of South Africa.

Weeds of New South Wales.

W. F. BLAKELY, Botanical Assistant, National Herbarium, Botanic Gardens.

Tumbling Mustard (*Sisymbrium altissimum* L.)
(*Cruciferæ* : Edge Mustard Family).

Popular description.—An annual, 2 to 4 feet high, much branched and bushy; seedling leaves forming a rosette on the ground, somewhat similar to the dandelion: coarsely lobed, sprinkled with scattered hairs; stem leaves deeply divided into very narrow segments. Flowers pale yellow; pods narrow, straight or curved, 2 to 4 inches long; seeds small, yellowish, oblong.

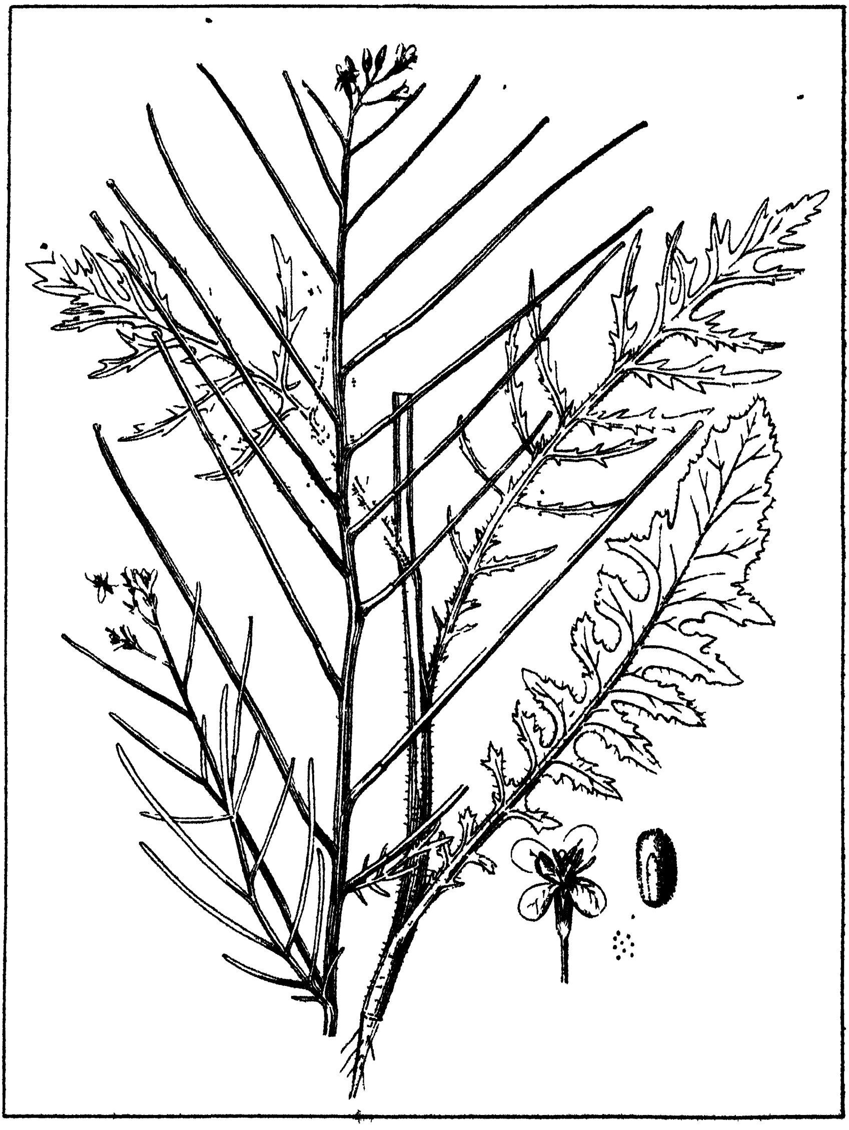
Botanical description.—Annual; stems erect; at first somewhat pilose at the base, smooth and slender, 2 to 4 feet high, profusely branched upwards, the fruiting branches occupying the greater portion of the plant. Basal leaves forming a rosette, more or less pilose; stem leaves glabrous, divided into long linear segments; the uppermost very fine, almost threadlike. Flowers pale yellow, about 3 inches broad; the pedicels 3 to 4 inches long, spreading or ascending, thickening as the pod develops pods linear, terete, 2 to 4 inches long, ½ inch broad, containing 50 to 120 small, oblong, yellowish seeds.

Botanical name.—*Sisymbrium.*—Derivation uncertain, but supposed to be the name of a sweet-smelling plant. Ovidius Naso, the celebrated Roman poet, advises that Venus should be propitiated with garlands of roses, of myrtles, and of Sisymbrium. It is, however, more probably derived from *siribos*, a fringe, as some of the species have fringed roots: *altissimum* very high, referring to the height of the plant in comparison with other species.

Common names.—Indian Head, Tumbling Weed, On' Appelle Tumbling Weed, French Weed. Tumbling Mustard is the name most frequently used, and it is the most appropriate, as the plant is a mustard, and distributes its seeds by tumbling or rolling before the wind.

Where found.—Mediterranean region and Southern Russia, also throughout the greater part of Europe, northern Africa, and western Asia. During the last twenty years it has been rapidly spreading in Denmark and northern Europe, while in some parts of Germany, Austria, and Russia it has long been a troublesome weed in cultivated fields and meadows. In the United States it is recorded for all the states of the middle west, as far as Missour and Kansas, northwards to Washington; all the Canadian provinces from Quebec to Vancouver Island. (United States Department of Agriculture, Circular No. 7, Sec. ed.)

Its appearance in Australia.—The first sample of Tumbling Mustard was forwarded to the National Herbarium for identification by the Inspector of noxious weeds, Boree Shire, Cudal, in November, 1920. It is not known when or how it was introduced into the district; probably in impure seed.



Tumbling Mustard (*Sisymbrium altissimum* L.)

Farmers should be on the alert for this weed, as the same agency which deposits it in one place will undoubtedly disseminate it in many others, and, therefore, it might exist as a seemingly harmless weed in other parts of the

State, and multiply and extend its range unnoticed. It is advisable for those interested in agricultural pursuits to ascertain the name and nature of any plant appearing on their holdings with the characters of Tumbling Mustard. In the growing crop it is conspicuous when in flower. As it grows up with the crop its pods ripen about the same time as the grain, a factor which makes it a troublesome weed during harvest.

A bad weed.—Mr. W. Saunders, Director, Experimental Farms, Ottawa, Canada, in "Department of Agriculture Bulletin, Weeds," No 28, refers to Tumbling Mustard as follows:—"I have no hesitation in calling this the worst weed we have in Canada. It is only about ten years since it was first noticed as a troublesome pest of the farm, and although great efforts have been made to control it, it has gradually spread over hundreds of thousands of acres in the north-west territories and Manitoba. It has all the bad characteristics of the other mustards, and besides is a large, free growing, exceptionally prolific plant, of which, when the seeds are ripe, the head breaks off and then becomes a 'tumbling weed,' being blown for miles across the prairies in autumn and during the winter, and in that way scattering the seeds quickly over wide areas."

Ada Georgia, in "Manual of Weeds," states that "the fecundity of the weed is almost incredible."

According to the United States, Department of Agriculture, Circular No. 7, second edition: "A well-developed annual plant of Tumbling Mustard, 4 feet high, collected in Assiniboia, in 1892, was carefully examined by Professor James Fletcher, of Ottawa, Canada, who found that the pods contained an average of 120 seeds each, and that the whole plant bore 12,500 pods, making a total of 1,500,000 seeds."

Means of control.—Prevent seed production by destroying plants before the seed is ripe. Wheat paddocks infested with Tumbling Mustard should be surface cultivated soon after harvest to encourage the seed to grow, and from time to time lightly scarified as the seedlings make their appearance. In a growing crop of wheat or oats seedlings should be harrowed out before the crop gets too tall. Plants that have survived and grown up with the crop should be hand-pulled when they reach the flowering stage.

CANKER IN TURKEYS.

"MY turkeys have a scabby disease from the neck to the top of the head, and in the mouths are cheese-like lumps which have an unpleasant odour."

The Poultry Expert's reply, of course, was that the disease was canker. One of the most effect remedies was touching the affected spots with iodine, though care must be exercised if the tongue and mouth were affected. If the iodine was too strong it should be diluted with glycerine. A saturated solution of permanganate of potash was also effective if applied in the same way.

The Cultivation of Ginger.

R. G. BARTLETT, Assistant Fruit Expert.

GINGER is the dried underground stem of a plant that grows wild in south-eastern Asia and some of the islands of the Malay Archipelago, but is cultivated in South America, the West Indies (more especially in Jamaica), and in the Philippines and Ceylon.

The plant requires a rich soil, the most suitable being a heavy black loam with a clay subsoil, possessed of plenty of moisture and well drained. Good potato soil is highly suitable. As the crop is gathered in April or May frosts do not affect it, but it should be grown where it will get a fair amount of sun. Flats are better than ridges.

The land should be thoroughly prepared by ploughing and harrowing to bring it into condition for planting in September. Drills are opened out 4 inches deep at distances of 2 feet apart, and the fertiliser to be applied is mixed with the soil in the bottom of the furrows. A couple of hundredweight of a mixture of equal parts of superphosphate and bonedust has been found a satisfactory dressing. The sets, which should consist of two eyes (growing points), are placed flat on top of the mixed manure and soil in the drills at a distance of 8 or 9 inches apart and covered to a depth of 3 inches. A mulch of dry grass 3 or 4 inches wide is placed along the drills over the sets to minimise evaporation and prevent the surface of the ground from setting hard.

Cultivation consists of stirring the soil and keeping down the weeds.

The crop is harvested about April, when in the flowering stage; if left longer it gets too tough and too hot for use. Special care must be taken not to injure the " hands " or rhizomes in digging them. A garden fork is the tool mostly used for the purpose. Practically no preparation is given to ginger before marketing, beyond freeing the hands of soil and placing them in sacks, care being taken to reject " plant ginger." These pieces are sometimes planted a second season when eyes are still present.

From 2 to 4 tons of ginger per acre is considered a fair crop according to the nature of the soil and the season. The price obtained in Brisbane recently was 1s. 6d. per lb., jam factories being the main consumers.

As the work of harvesting is tedious, and as the local market is only limited, the trade being accustomed to getting their supplies overseas, a beginner would be well advised to plant only a small area—say a quarter of an acre.

Green ginger for plants is obtainable from Chinese importers as well as many of the leading seedsmen.

The Preparation of Colloidal Sulphur.

A. A. RAMSAY, Principal Assistant Chemist, and W. W. COOKE, Orchardist,
Yanco Experiment Farm (late of Glen Innes).

It is generally known that apple mildew can be successfully controlled by the application of sulphur in a very finely divided state. The particles of ordinary flowers of sulphur are too coarse for the purpose, and under ordinary conditions the only practical ways of obtaining sulphur in a sufficiently fine condition are either to purchase it (the market price being very high) or to produce it on the farm. Fortunately the lime sulphur that nearly every orchardist now uses affords the means of doing the latter at a minimum of expense.

The following experiments in the preparation of colloidal sulphur from home-made lime-sulphur mixture and sulphuric acid, with and without the addition of glue, were carried out at Glen Innes Experiment Farm.

Experiment No. 1.—To five gallons of home-made lime-sulphur mixture and 1½ lb. glue dissolved in 4 quarts of water, dilute sulphuric acid (about 2¾ pints of commercial acid to 3 quarts water) was slowly added until the yellow colour of the solution had disappeared. After the reaction was complete, the weight of the precipitate obtained was 75·75 lb. The preparation was thoroughly mixed and a sample withdrawn for analysis, the result of which is given below.

Experiment No. 2.—To five gallons of home-made lime-sulphur mixture largely diluted with water was added dilute sulphuric acid (3 pints commercial acid in 1 gallon water) till no reaction was observed for sulphides and the mixture was just faintly acid to methyl-orange. About 2¾ pints of strong acid was required. It was noted that although there was no sulphide present on 26th October and that then the mixture had an acid reaction towards methyl-orange, on 27th October there were small but decided sulphides in solution, and the mixture, instead of being acid, was neutral or faintly alkaline towards the indicator. A little more acid was added to decompose the sulphides thus formed, and the whole allowed to settle. The water was then decanted off and the precipitate washed with water and finally transferred from the barrel in which the decomposition had been effected, to a smaller container for the purpose of weighing. The net weight of the product obtained was 133·38 lb. After thorough mixing a sample was withdrawn for analysis; the results are given below.

Table showing analyses of colloidal sulphur prepared at Glen Innes Experiment Farm on 26th–27th October, 1921.

	Experiment No. 1. (With glue.)	Experiment No. 2. (Without glue; largely diluted and washed.)
	Per cent.	Per cent.
Water	73·32	87·27
Dry matter	26·68	12·73
	100·00	100·00
Water	73·32	87·27
Sulphur	8·70	4·60
Insoluble matter	·05	·02
Thio-sulphuric acid	·25	·27
Sulphuric acid	5·72	2·96
Lime	5·82	2·86
Glue	1·98	nil.
Not determined	4·16	2·02
	100·00	100·00
Probably combined as follows:–		
Water	73·32	87·27
Insoluble matter	·05	·02
Sulphur	8·70	4·60
Calcium thio-sulphate	·38	·43
Calcium sulphate	12·29	6·37
Lime (left after supplying thio-sulphuric and sulphuric acids)	1·63	·63
Not accounted for (di and trithionates and water of crystallisation of CaS_2O_3) ...	1·65	·68
Glue	1·98	nil.
	100·00	100·00

Table showing amounts of colloidal sulphur obtained:—

	Experiment No. 1	Experiment No 2.
	lb.	lb
Weight of product obtained	75·75	133·85
Product therefore contains sulphur ...	6·59	6·14
" " " lime	4·41	3·82
1 gallon home-made lime-sulphur therefore yielded	1·318	1·228

Experiment No. 3.—This was carried out by one of us (W.W.C.) at Glen Innes Experiment Farm on 28th December, 1921.

To six gallons of home-made lime-sulphur mixture, 26 degrees Baumé, plus 12 gallons of water, was added dilute sulphuric acid (3·25 pints commercial strength diluted with 10 pints water). The net weight of the product obtained was 127 lb., and an analysis of the sample submitted was as follows :—

	Per cent.
Water	84·18
Dry matter	15·82
	100·00
Water	84·18
Sulphur	5·35
Thio-sulphuric acid	·49
Sulphuric acid	4·25
Lime	3·70
Not determined	2·03
	100·00

Probably combined as follows :–

Water	84·18
Sulphur	5·35
Calcium thio-sulphate	·78
Calcium sulphate	9·13
Lime (left over after supplying thio-sulphuric and sulphuric acids)	·44
Not accounted for	·12
	100·00

The following table shows the amount of colloidal sulphur obtained :—

	lb.
Weight of product obtained	127
Product therefore contains—lime	4·70
,, ,, ,, sulphur	6·79
1 gallon home-made lime-sulphur therefore yielded	1·132

The Results Analysed.

The results obtained in Experiments Nos. 1 and 2 indicate that a gallon of home-made lime-sulphur mixture of about 26 deg. Baumé will yield 1·27 lb. of precipitated sulphur, and that the whole precipitate obtained contains about 50 per cent. of gypsum or calcium sulphate.

If the result of Experiment No. 3 be averaged with Experiments Nos· 1 and 2, each gallon of lime-sulphur mixture used will yield 1·23 lb. of precipitated sulphur. To state the result in another way, 1 lb. of precipitated sulphur will be obtained from the decomposition of 3 quarts 8 oz. of home-made lime-sulphur mixture or roughly from ¾ of a gallon.

A Method of Manufacture Recommended.

The lime-sulphur solution should be prepared as described in Farmers' Bulletin, No. 72. This should test 26 deg. Baumé, and should it have a greater density, say, 27 or 28 deg., then water should be added to reduce the density down to 26 deg. before proceeding. Ten gallons of home-made lime-sulphur should be diluted with 25 gallons water in a barrel of, say, 40 or 50 gallons capacity. In a porcelain or earthenware jar, dilute 6 pints of strong commercial sulphuric acid with 9 pints of cold water and allow the mixture to cool. Carefully add the cold, diluted sulphuric acid to the diluted lime-sulphur in the barrel in small quantities (2 or 3 oz.) at a time, stirring well after each addition of acid, until the typical yellow colour of the original lime-sulphur disappears and until the further addition of more sulphuric acid produces no further precipitation of sulphur. This observation may be made in a 8-oz. glass measure or in a small bottle.

Allow the precipitated sulphur to settle—for a day or two, if necessary—and syphon off or decant the clear liquid above the precipitated sulphur. Further quantities of water, say, 10–20 gallons, may be added to the precipitate in the barrel and the whole stirred up thoroughly, allowed to settle well and the clear liquid removed as described above. Dissolve 3 lb. cheap glue in just sufficient hot water to render the glue soluble, and while still hot add the solution to the precipitated sulphur in the cask, stirring well so as thoroughly to incorporate the glue with the sulphur. The mixture so obtained should be diluted to 250 gallons with water for use; this will give a spray containing approximately 5 lb. precipitated sulphur per 100 gallons.

Alternatively, "stock" quantities of colloidal sulphur may be prepared by treating several lots of 10 gallons of home-made lime-sulphur as described, transferring the precipitated sulphur obtained to a stock barrel and pouring or decanting off all surplus water. When sufficient "stock" has been prepared, the weight or volume of the contents of the stock barrel should be determined. The number of gallons of home-made lime-sulphur used, multiplied by 1·25, will give the number of pounds of precipitated sulphur contained. When it is desired to prepare colloidal sulphur spray, withdraw an aliquot of the stock preparation and add the necessary water, and glue.*

For example, say five lots of 10 gallons of home-made lime-sulphur has been treated, and the resultant precipitates added together in the stock barrel weigh 300 lb. This 300 lb. will contain—

$5 \times 10 \times 1{\cdot}25 = 62{\cdot}5$ lb. precipitated sulphur.

Suppose it is desired to prepare 100 gallons of spray, 5 lb. of sulphur will be required. This will be contained in

$\frac{5 \times 300}{62{\cdot}5} = 24$ lb. stock colloidal sulphur mixture.

This quantity is weighed off, 1¼ lb. glue in solution added and diluted to 100 gallons with water for use.

*** The experience at Glen Innes orchard indicates that the glue added to the colloidal sulphur precipitate will keep without alteration for about three months.**

Cost of Preparing Colloidal Sulphur.

At the present approximate prices for sulphur, lime and commercial sulphuric acid, viz., £15 10s., £4 and £17 per ton respectively, the cost per pound of precipitated sulphur in colloidal sulphur will be about 5¼d., and the cost of 100 gallons colloidal sulphur spray (containing 5 lb. sulphur per 100 gallon) will be about 2s. 2¼d.

For comparison, it may be stated that the cost of each pound of precipitated sulphur in manufactured products of this type, ranges from 1s. 10¼d. when 100 lb. quantities are purchased, to 2s. 9¼d. when 10 lb. quantities are purchased, and to 4s. 5¼d. when 1 lb. quantities are purchased. The cost of 100 gallons of spray of similar strength to colloidal sulphur spray, made from such manufactured products, will range from 9s. when 100 lb. quantities are purchased, to 13s. 7d. when 10 lb. quantities are purchased, and up to 21s. 9d. when 1 lb. quantities are purchased.

In other words, the colloidal sulphur spray will cost only from one-quarter to one-seventh or one-tenth of a similar spray prepared from the manufactured or imported product, according to the quantity of the latter purchased.

THE EFFECT OF BLOOD MANURES ON CITRUS.

To what extent is a manure containing blood harmful in its effect on citrus trees? The opinion is frequently expressed that any manure containing blood produces fruit that is too red and coarse, and consequently not readily saleable; and that where "die-back" and black spot of citrus occur these diseases are aggravated by the application of such manure.

The coarsening effect on the skin of citrus trees, which it seems to be generally admitted attends the use of large amounts of blood and bone, is apparently due to excessive nitrogen.

As to the effect of blood, in the form of blood and bone, on the diseases mentioned, experiments have shown that although die-back was not cured by applications of blood and bone alone, neither had this manure the effect of increasing the disease. Blood and bone, plus sulphate of iron, ranked next to farmyard manure as a means of producing an improvement in the trees. In experiments conducted with blood and bone applied to Emperor mandarins affected with brown spot, moreover, there was no evidence of a resultant increase in the disease. No experiments as to the relationship between black spot of oranges and blood and bone have yet been conducted.

The experience of citrus growers generally seems to deprecate the heavy use on citrus trees of manures containing blood. "Growers in the Gosford district have realised for many years it is not advisable to continue heavy applications of manures containing blood on citrus trees," writes Mr. O. Brooks, Fruit Inspector in the district mentioned. "Bone and superphosphate, and occasionally potash, are preferred for spring manuring, and bonedust, or blood and bone, in the autumn. Blood is very seldom used for lemon trees. It has always been found suitable for passion vines with bonedust added in the form of blood and bone.."—G. P. DARNELL-SMITH.

Pure Seed.

GROWERS RECOMMENDED BY THE DEPARTMENT.

THE Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Intending purchasers are advised to communicate direct with growers regarding the prices for the seeds mentioned hereunder.

Maize :—	
Fitzroy	... J. P. Mooney, Taree.
Boone County White ...	... J Chittick, Kangaroo Valley.
Pop Corn:—	
White Rice	... Kable and Son, Orton Park, via Bathurst.
Clovers:—	
Shearman's Clover ...	... J. H. Shearman, Fullerton Cove, Stockton.
Grasses :—	
Paspalum dilatatum ...	... Manager, Experiment Farm, Lismore.
Elephant..	... Manager, Experiment Farm, Grafton.
	Manager, Experiment Farm, Lismore.
	Principal, H. A. College, Richmond.
	Manager, Experiment Farm, Cowra.
Kikuyu ...	.. Principal, H. A. College, Richmond.
	Manager, Experiment Farm, Lismore.
	Manager, Experiment Farm, Grafton.
Broom Millet:—	
Broom Millet	... W. G. Chaffey and Sons, Tamworth.

FOOD FOR PREGNANT COWS.

FARMERS are well advised to grow and conserve such laxative crops as oats, barley, lucerne, sorghum, maize, &c., to hand-feed cows for at least several weeks prior to parturition. Failing green crops or ensilage, the farmer should drench the cattle three weeks to a month prior to springing with 10 to 12 oz. of Epsom salts, commence feeding (usually on chaff and bran), and in the feed should mix daily 1 lb. linseed-oil cake or 3 oz. of raw linseed oil, which is a food as well as a laxative.

Fresh, clean water is essential at all times, and a lick should be accessible, a valuable one containing 1 part Epsom salts, 3 parts Liverpool salt, and enough molasses (usually 3 to 4 parts) to consolidate the other ingredients. Sulphate of iron, which is very valuable in normal times, should not be given with dry food or scrub, being too astringent.

Cows nearing parturition, and exhibiting symptoms of sickness, should be treated as follows :—"Backrake" and give about 2 gallons of a warm soapy water enema, and drench with 2 oz. of spirits of aromatic ammonia or whisky, well shaken up with 1 to 1½ pints of hot, raw linseed oil. In drenching give a little at a time, and do not drench through the nostrils, nor hold the tongue, nor rub the throat. These practices are likely to cause the liquid to enter the windpipe, and result in pneumonia. The above stimulant, in a pint of water, may be repeated every few hours if necessary.—F. WHITEHOUSE, B.V.Sc.

DEPARTMENT OF AGRICULTURE

NEW SOUTH WALES.

Stud Pigs for Sale

AT

Hawkesbury Agricultural College and Experiment Farms.

AT Hawkesbury Agricultural College pedigree pigs of the following breeds are available for sale, viz.:—Berkshire, Tamworth, Poland-China. Prices range from £8/8/- to £17/17/- according to age, and include crates, insurance and freight to any New South Wales Railway Station or to any wharf in New South Wales where steamers call from Sydney.

Various strains of pedigreed Pigs are also available for sale at the following Experiment Farms (minimum price, £3/3/- each).

BERKSHIRES - - -	**Yanco Experiment Farm.** **Wagga Experiment Farm, Bomen.** **Cowra Experiment Farm.** **Wollongbar Experiment Farm, Lismore.**
MIDDLE YORKSHIRES -	**Bathurst Experiment Farm.** **Glen Innes Experiment Farm.**

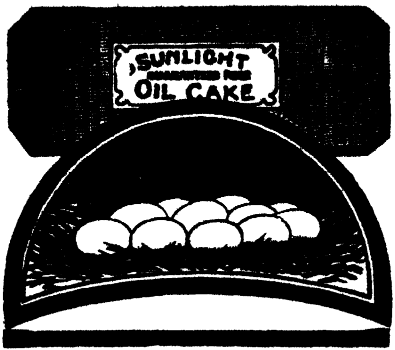
Orders are fulfilled in priority of application.

When placing orders full forwarding instructions should be furnished together with remittance.

Further particulars and prices can be obtained on application from the Principal, Hawkesbury Agricultural College, Richmond, or from the Managers of the institutions mentioned.

G. VALDER,

Under Secretary and Director,
Department of Agriculture, Sydney



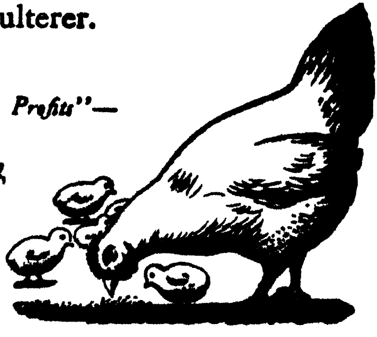
MORE EGGS!

SUNLIGHT OIL CAKE is rich in Albuminoids and low in Moisture.

The general cause of shortage in eggs is either too high feeding or too low. For laying hens, Sunlight Oil Cake will quickly give a return which will astonish the owner. For chickens at any time after the age of 6 weeks it is unequalled.

Sunlight Oil Cake will impart the glossy sheen to the birds' appearance so prized by the fancier, and is specially valuable for this reason alone to all exhibitors of show poultry. It puts on solid flesh in an extremely short space of time, and experiments have proved that young, scraggy birds fed almost entirely on it have become covered with good plump meat in a few weeks, thus doubling their value to the market poulterer.

A 32-Page Booklet—"Poultry Profits"—
sent free on application to—
Lever Brothers Limited,
Sydney.



Poultry Notes.

NOVEMBER.

JAMES HADLINGTON, Poultry Expert.

AT this time of the year the problem of providing ample accommodation to meet the necessities of the increasing stock is a severe tax on many poultry-keepers, owing to the high prices of building materials. But notwithstanding this, it is a circumstance worthy of note that the class of poultry buildings being erected at the present time is much in advance of that erected in any previous period in the history of poultry-keeping in this State. This points to the increased importance now being attached to the industry. Nevertheless, most poultry farms are still more or less congested in this respect. There is, too, a somewhat general lack of knowledge on the matter of what constitutes adequate housing for a given number of birds.

In addition to the cases of this kind that come under observation, a good deal of inquiry is received on this subject, and some information with regard to it will doubtless be of service.

Having regard to reasonable run-space, the housing accommodation becomes the determining factor in the carrying capacity of the farm, and failure to provide ample, well ventilated buildings is a frequent cause of sickness, and also of unsatisfactory results in regard to egg production. We cannot secure the latter without healthy hens, and we cannot have healthy fowls without ample fresh air, no matter how we may treat them otherwise.

Housing.

Generally speaking, the housing of adult poultry may be divided into two main systems—(*a*) roosting room only; (*b*) roosting accommodation plus a portion of the house devoted to scratching material.

For roosting room only, the long, narrow shed is probably the best; that is to say, a shed 6 or 8 feet wide, carrying two or three roosts respectively, running the whole length of the building. Such a shed, no matter what its length, should be at least 5 feet high at the back, and 6 feet at the front. The house in which the scratching-shed principle is to be a feature, and which is known as semi-intensive, will need to be 14 to 16 feet wide, by whatever length desired, determined, of course, by the number of birds to be accommodated. Such a building will require to be somewhat higher than the other, and should be at least 6 feet high at the back and 8 feet at the front. Both classes of house should either be open-fronted or covered with wire netting in front, and should face the north.

A consideration in regard to open-fronted sheds is that when the length is over 20 feet, it is advisable to put in partitions. Thus, if a shed is 60 feet long, a partition should be put in at every 20 feet—in the case of the narrow shed the whole width of the building, while in the wide shed half the width of the building will be sufficient. These partitions are for the purpose of breaking the draught that would otherwise enter at one end of the shed and sweep the whole length of it. In either case it is not sufficient that the front of the house be open; an aperture, at least 4 inches wide, should also be left under the back eaves of the roof to allow the passage of air through the building. Even an open-fronted shed is not ventilated unless there is such an opening.

In the narrow sheds, two or three perches should run the whole length, while in the wide ones, about 6 feet will be devoted to roosting accommodation —at the back for preference—and the front portion will be given up to scratching litter. A board about 12 inches high running the whole length of the building is necessary to divide the scratching material from the roosting quarters, the latter being simply sanded over to keep the excreta from adhering to the floor.

Sizes of Houses.

The following tables show the approximate sizes of house recommended. Slight variations are necessary, one way or the other, in accordance with the breed to be housed. Table A below shows the approximate dimensions of houses for various numbers of hens to be housed in narrow sheds (roosting room only).

TABLE A.—Roosting Houses only.

No. of Hens.	Length.	Width.	Height at front.	Height at back.	No of Roosts.
	ft.	ft.	ft.	ft.	
10	6	5	6	5	2
20	7	6	6	5	2
30	10	6	6	5	2
50	15	6	6	5	2
100	30	6	6	5	2
150–200	35	8	6	5	3

Table B shows the approximate dimensions of houses for various numbers of hens to be housed on the semi-intensive system.

TABLE B.—Combined Roosting and Scratching Houses.

No. of Hens.	Length.	Width.	Height at front.	Height at back.	No. of Roosts.
	ft.	ft.	ft.	ft.	
100	16	14	8	6	4
150–200	22	14 to 16	8	6	4

If it is desired to run a small number of birds (up to fifty) on the semi-intensive system in the long, narrow pens, either the length of the shed can be doubled, or the number of birds halved.

House Young Stock in Small Numbers.

One of the big mistakes made is to house large numbers of growing stock, between the ages of 12 weeks and 6 months, in one building. Birds of this age are best handled in flocks of not more than fifty head. From 6 months onwards they may be run as adults.

With regard to the early-hatched pullets, which are so liable to break into moult, it is suggested that the breeding pens (where suitable) be utilised for housing them in small numbers. For instance, breeding pens such as those on soldiers' settlements can be used in this way, and would each accommodate fifteen to twenty pullets. In this way very much better results in egg production can be obtained with these very early pullets than if housed in larger numbers. Of course, the number of these to be dealt with is small compared with the whole of the season's rearing.

Materials for Housing.

As far as roofing is concerned, it is not intended to advocate any special material other than galvanised iron, which is, undoubtedly, the best if procurable. As regards the walls of poultry houses, probably the cheapest material of a permanent character at the present time is sawn palings on the lap-and-space principle. The life of such a wall, when properly built, is from twenty to thirty years, and practically no maintenance is necessary, nor does it require painting, which in itself is an economical consideration.

Meat Meals.

Questions received on the subject of how to use meat meals, and whether they should be used in summer as in winter, indicate that the matter is not yet well understood by many. For the information of such as are in doubt, it might be stated that taking the ordinary foods used for poultry (say, wheat, maize, oats, and barley and their meal-products) used for the morning mash, together with lucerne, with or without a small percentage of some of the oil cakes, examples of which have been given from time to time in these notes and in publications issued by the Department, about 5 per cent. to 7 per cent. only of M.I.B. meal or Compo-meal is required to be added to the morning mash to balance the ration to the desired standard for laying hens.

In this connection it might be pointed out that such a ration is suitable for both winter and summer. As a matter of fact, it is particularly necessary to keep up the proteid content of the ration at this time of the year, when the hens are at the height of their laying season, or are just passing it. It stands to reason that the most nourishing food is necessary to sustain egg production, especially in the case of the older hens.

It must be emphasised, however, that the principle of feeding a balanced ration is sound for both winter and summer—when the hen is not laying eggs she is invariably preparing for or actually making a new coat of feathers.

November Work in the Apiary.

W. A. GOODACRE, Senior Apiary Inspector.

WHERE good spring conditions have been in evidence, the apiarist will be looking forward to a busy time during November. It is often found at this period that the bees have stored sufficient honey to warrant the use of the honey-extractor. The bee-farmer should take advantage of the progressive times to rear good queens to replace any that have not proved up to standard. As mentioned for October work, particular attention will be again necessary at this period to minimise swarming, and where desired and conditions are favourable, artificial increase may be carried out.

With regard to the extraction of honey from the hives, the beginner is often under the impression that extracting work should be carried out a fixed number of times per season, and during certain months. This is a very undesirable practice to follow, however, as a simple explanation will show. There are very few plants or trees of great honey-producing quality that flower every season. Sometimes it is the early-flowering flora that gives the surplus; during other seasons very little storing may be done by the bees until the autumn; yet again, in good localities there are seasons when the honey flow will be continuous from October until March, and populous colonies will store probably 60 lb. of honey every three weeks. The best way to find out when to extract, is to watch the progress in the hives, add supers, keeping a little ahead of progress made by the bees until the hive is well built up, and then it is an easy matter to decide that the colony has sealed stores above their requirements. It is advisable for the beginner, until a knowledge of conditions is gained, to keep a little on the safe side by leaving some stores for the bees, and to be particularly careful when bees are inclined to rob freely, or when extracting work is carried out toward the close of the season.

To the inexperienced man it would appear that to extract the honey which the bees had expended so much energy to store would have a disheartening effect; but such is not the case; if the extracting work is carried out when conditions are progressive, the spirit of the hive is raised, and the bees go to work with renewed energy, and appear to delight in the opportunity given them to store a further supply of honey. Bees often become discontented when nectar is available and there is insufficient storage room in the hive; with this condition obtaining, the brood nest of the colony from which the population comes will be congested by the bees storing honey in excess in the brood chamber of the hive, and the result of this congestion is to induce swarming ideas. Apart from this the population of the hive is likely to be seriously reduced.

Increasing the Supply of Combs.

The value of having available an ample supply of good combs on a bee-farm cannot be over-estimated, and as the bees require stimulating conditions combined with warm weather to enable them to build out comb, even when comb-foundation is used, advantage should be taken of the good conditions during a honey flow to get a good number of combs built. Many beginners place supers containing comb-foundation in the hives irrespective of the conditions obtaining, only to find out later that the time has not been favourable, and that the bees have made no attempt to work on the foundation. At times when bees are unable to build out foundation, much is often gained by being able to supply combs. It does not impart a great strain on a populous colony to build out combs from foundation during a honey flow, and to assist the bees at this period, there is no doubt a considerable amount of natural wax secretion.

To Find Bee-trees.

This is generally a favourable period for finding bees in bee-trees, and as many make a start in bee-keeping by obtaining bees from bush trees, a few hints on how to find the bees home should be useful. Bees use a large quantity of water in the elaboration of food for their larvæ, and in obtaining water the bush bees give the best chance for one to discover their home. It would therefore, be advisable first of all to make a systematic search of the water courses in a selected locality for the purpose of finding bees watering. From the water the bees, if given a clear flight, will fly straight toward their home. After keen observation of the flight of a number of bees has been made, it is possible to establish a good sight line and a search can be made in the trees. stumps, logs, &c., to find where the bees have their home established. Sometimes when bees leave the water to fly home, a nearby hill or scrub may cause them to swerve in their flight; in such cases a little judgment is necessary before a good line can be established. By standing back a little from the watering-place, and watching the bees fly past, a longer view of their flight can usually be obtained. Bees often select several watering places, and it is a good plan to line them from the different points; the intersection of these lines will give a fairly accurate idea as to the position of the bee-tree.

CONDITIONS THAT FAVOUR OATS.

THE conditions that favour the successful cultivation of oats cannot be considered altogether satisfactory from a wheat-growing point of view. Speaking generally, the best oat-producing countries have a cold climate associated with a high average rainfall, whereas with wheat the best results are usually obtained in comparatively warm countries with only a moderate or even a low average rainfall. The United States of America is the greatest oat-producing country of the world, the proportion of oats to wheat grown being as three to four—in other words, 3 acres of oats are grown to every 4 acres of wheat.—J. T. PRIDHAM, plant-breeder.

The Manuring of Bananas.

R. G. BARTLETT, Assistant Fruit Expert.

ALTHOUGH the manuring of bananas is now receiving more attention than formerly it is not even yet carried out by the great majority of growers on the right lines.

Bananas are a crop that, both in regard to the fruit itself and to the large quantity of vegetable matter produced, make heavy demand upon the soil. They may be said to be voracious feeders, and to ensure maximum returns year after year, therefore, it is most essential that the fertility of the soil be maintained by every possible means. In a measure the truth of this is coming home to growers, who, however, have not yet given a great deal of consideration to the means by which it may be most profitably and efficiently done.

Fertilisers are being used by a number of growers, but too often incomplete mixtures are being applied where complete ones are needed, and in other cases where the mixtures are more complete they are not being supplied in the best proportions, while upon almost all hands insufficient attention is being given to the maintenance of the supply of humus in the soil. This all-important substance not only provides plant-food in itself, but it has a very valuable general influence upon the soil, opening it up, aerating it, receiving and retaining the maximum amount of moisture, and thus providing conditions favourable for the soil bacteria to act upon the mineral matter in the soil and to turn the plant-food therein into a condition in which the crop can make use of it.

The Importance of Humus.

A number of cases have occurred on the North Coast where soils lacking in humus have made practically no response to artificial fertilisers, and the only hope the grower has in such cases is to adopt a practice that will repair the greatest deficiency (that of humus), and thus provide the conditions that will make expenditure on fertilisers worth while.

It is suitable, therefore, that in dealing with the matter of manuring banana lands, reference should be made first to the means by which humus may be added to soils.

Humus is decayed and decaying vegetable and animal matter. There is a certain amount of it in most soils—least of all in sandy soils, and most in heavy loamy ones. It is continually undergoing change, however, and the supply is always diminishing, whether the soil is being cultivated or not. Indeed cultivation has the effect of hastening the oxidising or burning up of this decaying vegetable matter, and hence it is that soils that are in cultivation require to be supplied with material that will become humus.

Any vegetable matter that will decay fairly rapidly is suitable for the purpose, be it weeds, leaves, or crops grown for the purpose. In the banana districts of this State there is usually an abundant growth of soft weeds in the wet season, and banana growers might well take advantage of this as one means of supplying the soil with vegetable matter. Quite rightly growers like to see their land free from weeds, but an inexpensive cover crop could be obtained by allowing the weeds to run up in the rainy season, then chipping them off and allowing them to lie on the surface to decay and humify there.

What Cover Crops Do.

Cover crops may be grown for the purpose of supplying humus to the soil; and, indeed, on account of the abundance of material they provide and the contribution they make to soil fertility, they should be part of the practice of every grower. Their advantages as a general feature of farm work may be stated thus:—

1. They supply humus, thus adding to the amount of plant-food in the soil, improving the texture, and increasing the capacity for receiving and retaining moisture.

2. They provide a useful mulch while decaying, preventing evaporation during a dry period.

3. They prevent the washing away of the rich surface soil during heavy falls of rain, being of especial value in this respect on steep faces.

4. They protect the surface roots of the bananas from scorching and drying out during hot weather.

5. They reduce work by saving two or three chippings in the season of greatest weed growth—January, February, and March.

The only disadvantage attaching to cover crops is that the runners of certain kinds of crops have to be pulled away from the banana stools occasionally, but the amount of work so entailed is so small that any one of the advantages named greatly outweighs it.

Failures with cover crops may be said to be traceable to two things:—(1) Neglect to cultivate the soil and to keep it free from weeds until the young crop is fairly well established; (2) planting among old plantations where there is not sufficient light and air to allow the cover crop to grow properly.

When and What to Plant.

The best time to plant cover crops is November and December, following a good fall of rain. They will quickly establish themselves to the exclusion of weeds.

Various plants are suitable for the purpose, but none are so good as the legumes, which fix atmospheric nitrogen and store it in roots, stems, and leaves, thus adding substantially to the nitrogen content of the soil when the growth is cut down and allowed to decay.

Of legumes suitable for the purpose mention may be made of Rice bean, Velvet bean, Giant Red cowpea, Mauritius bean, and Pigeon pea. Rice bean has several recommendations, its haulm being less woody than those of some other legumes, and therefore decaying more rapidly after being cut down.

The ploughing under of cover crops in the autumn cannot be practised among bananas as among other fruiting plants and trees—the disturbance of the surface roots would be too great—but chipping off is sufficient and the crop rots on the ground.

When cover crops are grown among bananas less nitrogenous manure can be used in the fertiliser mixture.

Fertilisers that are Useful.

Great as is the value of cover crops, commercial fertilisers are also essential to the banana grower, and, as already stated, various mixtures have been used with more or less success.

Analyses of Cavendish banana plants and fruits have shown there to be more than twice as much potash present in their ash as of nitrogen and phosphoric acid combined. This seems to indicate the necessity for including potash in some form in banana manures, but in the past often only nitrogen and phosphoric acid have been supplied—largely the result of lack of knowledge on the part of growers. Actual experiments have shown that a complete manure containing nitrogen, potash, and phosphoric acid gives the best results, and, further, that when the potash is omitted the fertiliser barely pays for itself. Departmental tests have demonstrated that among the best mixtures for average soils are the two following, either of which the grower may try:—

No. 1—2 lb. dried blood... ... ...
1¼ lb. superphosphate ... ...
1 lb. sulphate or muriate of potash ...
} per stool every six months.

No. 2—1¼ lb. sulphate of ammonia ... ...
1¼ lb. superphosphate ... ...
1 lb. sulphate or muriate of potash ...
} per stool every six months.

One of these mixtures may be applied in March and September of each year.

Inquiries have been received from time to time from banana growers with reference to guano, it being apparently thought that that material has some value, but it must be pointed out that guano is of variable chemical composition. In any case, sulphate or muriate of potash should always be added when guano is used, as it is deficient in that respect. One part of potassic manure to four parts of guano may be found suitable.

Lime may be necessary on some banana soils. It should be applied at the rate of 2 to 4 tons agricultural lime per acre, at least six weeks before the application of artificial fertilisers. The autumn is the most suitable time, and dressings may be made every four years.

Orchard Notes.

NOVEMBER.

W. J. ALLEN and S. A. HOGG.

DURING this month the ground in the orchard should be kept thoroughly cultivated and free from all weeds. This is absolutely essential to the success and productivity of the orchard.

By the loosening and breaking up of the surface, soil moisture is retained, and the weeds either completely killed or kept in check. It is essential during the growing period to keep the land free from weeds, as they are great robbers of the moisture that is so necessary. It will be necessary to give refills (young trees planted where older ones have failed or been removed) some special attention. They should be mulched with decomposed vegetable matter, or, if this cannot be procured, the soil round them should be kept loose. If the young trees are suffering from lack of moisture, they should be given two or three buckets of water until they have sufficient root-hold to maintain their existence. It may be found that even in a young orchard that has just recently been planted a few trees are showing distress. This may be a constitutional weakness, and it will be found an advantage also to give them a little special care.

Summer pruning.

The principle of summer pruning is the maintenance of an even and well balanced tree by the shortening back of any leaders that may be receiving too much sap to the detriment of the remainder of the tree. Pinching back these vigorous leaders during the growing period will greatly assist in forming a symmetrical tree. Again, superfluous growth, such as the young laterals that are forming in the centre of the younger trees, may be checked. In starting young trees, at least three leaders should be left; occasionally four may be left, but generally speaking three will be sufficient, as it is rare for the sap to be equally distributed amongst more than three leaders. In fact, careful observation will often show that even with three leaders sap is often monopolised by one; this being so, the vigorous leader must be kept in check and it may be necessary to pinch it back on three or four occasions during the growing period.

With regard to the older trees—those that are in bearing—superfluous growth should be checked in their cases, but care should be taken to encourage lateral growth that in future will carry the fruit. Any branch that is particularly vigorous may be checked during the growing period, that is to say, the terminal bud may be pinched off.

Thinning Fruit.

The Department invariably recommends that where the trees are carrying a very heavy crop it is an advantage both to the tree and to the fruit to remove a certain proportion; but it is found to be very laborious, and most growers cannot reconcile themselves with the fact that after growing a tree for a certain time they should rub some of the fruit off. In actual practice it will be found that a tree that carries a fair average crop from year to year is far more profitable than those trees that bear a heavy crop once in three years.

With regard to the practice of thinning itself, two methods may be adopted. One method is the removal of some of the fruit, spacing out those that are left to about 3 to 6 inches apart. This particularly refers to peaches, apricots, apples, and pears. Another method is to remove a large portion of the laterals that are carrying the fruit, shortening them in, and thus leaving the fruit close to the main branches, where it is less liable to damage or to be blown off. In the case of plums, particularly Japanese, a lot of this work can be done during the winter pruning by the removal of the fruiting spurs; but if this has been overlooked and the trees are carrying abnormal crops, then at least 50 per cent. of the fruit should be removed.

Harvesting of Cherries, Peaches, and Apricots.

In harvesting cherries, it is an advantage to have them picked as early in the morning as possible, while the fruit is cool. In fact, providing they are dry, this remark applies to all fruits that are to be marketed as fresh. In the case of cherries, care should be taken in picking that the stalks are left adhering to the fruit. In packing cherries, the first layer should be laid on its side, the stalks being turned inwards. The remainder of the fruit (making up 12 lb. in all) is then placed in the box, and the bottom then becomes the top, and should be branded so that the brand indicates which side should be opened.

In the early districts along the coast both peaches and apricots will be ripening this month. Peaches should be packed in half-bushel cases, or if the fruit is of particularly high quality it might be packed in baskets containing from 3 to 4 lb. in each.

Grafts.

Attention should be given to any grafts that may have been inserted during August or September. The vigorous growth should be checked with a view to strengthening the scions. It is always advisable to leave really more than what will be eventually required, as the young growth, if weak, may be blown off. The young growth should be so handled as to provide a well balanced and symmetrical tree, the inside laterals being shortened back from time to time.

Fungus Diseases.

If during this month the trees are attacked by fungus diseases, such as shot hole fungus in the apricots and leaf curl among the peaches, the trees may be sprayed with Bordeaux mixture or lime-sulphur at summer strength.

It is always advisable to prevent fungus diseases rather than to try to cope with them after they have appeared. This being so, Bordeaux mixture at summer strength should be used as a spray on the grape vines, and in moist districts where vines are subject to oidium they should be dusted with sulphur.

Pruning of Oranges.

In pruning oranges care should be taken to remove water shoots that are running up through the centre of the tree. In cases where they are growing vertically from the branches, they should be checked with a view to producing lateral growth. According to their position they should be shortened from 3 to 4 inches to a foot in length. The best quality of fruit is produced on the lateral wood, and may be described as hanging rather inside the outer limits of the tree. This fruit is not immediately exposed to the rays of the sun, but it is not actually in the centre of the tree where it would have very little light.

Care should be taken to allow sufficient light to penetrate the tree in order that the young fruiting wood on the inside may be developed, without the main branches being exposed to the direct rays of the sun. The diffused light so admitted and the air will be found sufficient to prevent this young wood, which is of great value, from suffocation and death.

The stocks of citrus trees at all times should be protected from the sun and hot winds. In the younger trees, bags or hessian or whitewash may be used; in the older trees the foliage should be permitted to hang well over, down to a distance of 1 foot from the ground. This foliage not only protects the trunk, but also assists in keeping cool the surface roots.

PROVIDING WATER FOR BEES.

THE bee-farmer when selecting a site for his apiary, should generally endeavour to get near a permanent water supply, for bees require an ample supply of good water especially during the hot weather. If there is neglect in making provision for water near the apiary, there is considerable wastage of energy on the part of the bees in searching for a supply, and in carrying it a long distance. It is not a very difficult matter to provide a water supply even if containers have to be used. A container offering a good surface of water is preferable, and cork floats can be put in the vessel to prevent the bees from being drowned. Another method is to bank sand in each side of the vessel, and place a cover over the water which is in the centre; the bees will obtain the water from the moist sand. It is important that the water supply be kept fresh. A supply of water in the apiary grounds is especially advisable where bees are kept in towns, so as to get the bees into the habit of obtaining water at home, and not searching about the neighbours' homes for a supply.—W. A. GOODACRE.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

Society.	Secretary.	Date.
1922.		
Tweed River A. Society (Murwillumbah)	T. M. Kennedy	Nov. 29, 30
1923.		
St. Ives A. and H. Association	A. K. Bowden	Jan. 12, 13
Kiama Agricultural Society	G. A. Somerville	,, 25, 26
West Bargo A. H. and I. Society	L. J. C. Hicks	,, 26
Gosford A. Association	H. G. Parry	,, 26, 27
Wollongong A. H. and I. Association	W. J. Cochrane	Feb. 1, 2, 3
Inverell P. and A. Association	A. L. Varley	,, 6, 7, 8
Tahmoor and Couridjan	E. S. Key	,, 9, 10
Yanco A. Society (Leeton)	W. M. Evans	,, 13, 14
Shoalhaven A. and H. Association	H. Rauch	,, 14, 15
Tilba A. P. and H. Society	R. G. Swan	,, 14, 15
Dapto A. and H. Society	E. G. Coghlan	,, 16, 17
Guyra P. A. and H. Association	P. N. Stevenson	,, 20, 21, 22
Nepean District A. H. and I. Society (Penrith)	C. H. Fulton	,, 22, 23, 24
Wyong District A. Association	G. L. Garnsey	,, 23, 24
Kangaroo Valley A. and H. Association	L. W. Vance	,, 23, 24
Newcastle A. H. and I. Association	E. J. Dann	,, 27, 28, Mar. 1, 2, 3
Robertson A. and H. Society	E. S. Martin	Feb. 28, Mar. 1
Alstonville Agricultural Society	W. J. Dunnet	,, 28 ,, 1
Moruya A. and P. Society	H. P. Jeffery	,, 28, ,, 1
Griffith A. Society	M. E. Sellin	,, 28, ,, 1
Braidwood P. A. and H. Association	R. L. Irwin	,, 28, ,, 1
Oberon A. H. and P. Association	C. S. Chudleigh	Mar. 1, 2
Central New England P. & A. Assoc. (Glen Innes)	Geo. A. Priest	,, 6, 7, 8
Orange A. and P. Association	G. L. Williams	,, 6, 7, 8
Tumut A. and P. Association	T. E. Wilkinson	,, 7, 8
Bangalow A. and I. Society	W. H. Reading	,, 7, 8
Hunter River A. and H. Assoc. (West Maitland)	J. S. Hoskins	,, 7, 8, 9, 10
Berrima A. H. and I. Society	W. Holt	,, 8, 9, 10
Blacktown A. Society	J. McMurtrie	,, 9, 10
Rydal A. H. and P. Association	S. B. Prior	,, 10
Mudgee A. P. H. and I. Association	S. H. Somerville	,, 13, 14, 15
Cobargo A., P. and H. Society	T. Kennelly	,, 14, 15
Crookwell A. P. and H. Society	C. H. Levy	,, 15, 16
Camden A. H. and I. Society	G. V. Sidman	,, 16, 17
Batlow A. Society	C. S. Gregory	,, 20, 21
Campbelltown A. Society	J. T. Deane	,, 21, 22
Upper Hunter P. and A. Association (Muswellbrook)	R. C. Sawkins	,, 21, 22
Royal Agricultural Society of N.S.W.	H. M. Somer	,, 26 to April 4
Moree P. and A. Society	C. G. Hobbes	Apr. 17, 18, 19
Clarence P. and A. Society (Grafton)	L. C. Lawson	,, 18, 19, 20, 21
Ulmarra P. and A. Society	R. N. Shaw	,, 25, 26
Maclean P. and A. Society	R. D. Munro	May 2, 3
Narrabri P. A. and H. Association	E. J. Kimmorley	,, 2, 3
Hawkesbury District Association (Windsor)	H. S. Johnston	,, 3, 4, 5
Junee P. A. and I. Association	T. C. Humphrys	Aug. 21, 22

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Agricultural Gazette of New South Wales.

Field Experiments with Wheat.

SUMMARY OF VARIETY TRIALS, 1911 TO 1921.

Cowra Experiment Farm.

R. G. DOWNING, B.Sc.(Agr.), Senior Experimentalist, and C. McCAULEY, Experimentalist.

DURING the past ten years a large number of wheats has been tested at this farm for both hay and grain with the object of ascertaining the highest yielders over a period of years. In the early years of the experiment a fed-off section was also included, as it was thought that useful information might be so obtained as to the effect upon the ultimate yields of the varieties when fed off during the early stages of growth A number of difficulties were encountered, however, and so many factors are involved in such a test upon plots measuring only one-tenth of an acre that this section was later omitted from the trials.

Before going into details of the actual tests some particulars regarding farming conditions in the Cowra district may be given.

Cowra is situated 226 miles from Sydney, on the river Lachlan, and although included in the district known as the Central Tablelands, is on the extreme western fringe of the division, with climatic conditions in most respects more akin to those of the Central-western Slopes. The average yearly rainfall is 24·6 inches, distributed fairly equally throughout the year. The surrounding country is undulating to hilly, with the hills for the most part studded with granite boulders. The soil varies from a chocolate sandy loam to a clay loam, the lower levels consisting of the latter. Taken on the whole, the soil is uniform, although one frequently finds slopes (which in most cases should never have been cleared) from which the surface soil has been completely removed by erosion. Speaking generally the locality may be termed first-class wheat land.

The district is well adapted for mixed farming, and grows splendid crops of wheat and oats, while lucerne, peas, sorghum, and Sudan grass, together with other minor crops, also do well. Even in drought years a payable crop of wheat may be produced, and owing to the good summer rainfall it is as a rule possible to obtain a profitable crop of Sudan grass for hay if the wheat crop has not been up to the average. The growing season for winter cereals is usually a long one. Wheat may be grown for hay or grain, the weather at harvest time being as a rule dry enough to enable the production of a good sample of hay.

Wheat-growing occupies first place in the farming practice of the district, which is closely settled, most of the farms being well improved, and averaging about 600 acres in area. Sheep do not figure in the average scheme of farming to the extent that they should. Land values range from £8 to £12 per acre.

Owing to the practically assured rainfall, fallowing every second year may no be necessary, but the growing of rotation crops is certainly essential. The prevalence of black oats, and the extent to which such weeds as paddy melon and cape weed are spreading, show that a system of farming including fodder crops in rotation with winter cereals is eminently desirable.

Planting.

Owing to the long growing season, with its well-distributed rainfall, a considerable choice of both early and late maturing varieties capable of good yields is available, and the operation of sowing may therefore be spread over a fairly long period. The experiment has been divided into a hay and a grain section, and with the object of observing the suitability of the varieties for early, midseason, and late sowing, corresponding sections have been arranged. Until latterly the practice has been to plant the early sown section about the second week in April, the midseason section about the second week in May, and the late section about the second week in June. The late planting has been omitted from the trials during the last two seasons, however, the conditions (which are frequently either very wet or very dry at this time of the year) making it difficult to space the plantings the required period apart. This means that the two remaining plantings now take place about a week later than under the arrangement existing formerly.

The area of the plots has varied over the period under discussion from one-tenth to one-eighth of an acre, the width being that of a 15-disc drill (13·5 links) and the exact measurement being arrived at by cutting down the length of the plots before harvesting. This year, in order to ensure greater accuracy, the plots have been sown in duplicate with a 9-disc drill, the area of each being one-twentieth of an acre; and this is the procedure to be adopted in future.

The practice is to cut the hay section with the binder as each variety reaches the flowering stage, stook the crop on the plots, and weigh it when it is considered fit to stack. The varieties in the grain section are harvested by stripper, winnowed, and the produce weighed.

Treatment of the Land.

The rotation adopted in the early stages of the experiment was wheat alternating with rape, the procedure being to plough the land as soon as possible after harvest and to sow the rape in February. When the crop attained a height varying from 1 foot to 2 feet, according to the season, sheep were turned on to it, and it was alternately allowed to recover and grazed until August or September, when the residue was ploughed in. The land was then cultivated to conserve moisture and to kill weeds until planting.

Of recent years, for various reasons, the growing of rape has been discontinued at Cowra Farm, and the treatment of the land for experiments has consisted of grazing the stubble of the preceding wheat crop until August or September, when the land has been ploughed and the fallow well worked until sowing time. This treatment allows of the land being cropped with experiments every second year, and although not recommended as a general practice for the district, it allows of the maximum use of a limited area of uniform land for experiments.

The site of the experiments has been changed on several occasions during the course of the trials, but the texture of the soil on Cowra Farm does not vary to any great extent, and may be termed fairly typical of the district, so that the yields should not have been affected by the changes. The erosion referred to previously, however, has in certain years affected the yields to varying extents, so that it is considered necessary to stipulate a minimum difference of 10 per cent. between two varieties before saying that one is a superior yielder to the other.

In choosing new varieties for trial advantage has been taken of the location of Mr. J. T. Pridham, Plant Breeder, at Cowra Farm, and he has from time to time submitted new crossbreds or introduced wheats which have appeared promising in his single-row plots.

The tables below do not include a number of wheats which are at present under trial, but which have been tested for less than three years. Similarly, varieties that have been tested for less than three years, but which for various reasons have been discarded, have not been included. These, together with the reasons for their being discarded, are referred to under the heading "Notes on Varieties."

During the period under review diseases have not affected yields to any appreciable extent. Speaking generally, rust is only very troublesome in this district in very wet seasons, while bunt may be easily controlled by pickling. During recent years the spread of take-all (*Ophiobolus graminis*) and foot rot (*Helminthosporium* sp.) in the district show the necessity for the adoption of a more diversified system of farming, including a bare fallow every few years. As far as the experiment plots are concerned (owing to the system of a fallow every second year), such disease as has appeared has been well under control.

On several occasions losses have occurred in wet years through the lodging of varieties which, if sown early, are inclined to grow too rank, with consequent weakening of the straw. Since the same effect would have resulted in the case of such varieties grown under similar conditions upon a large area, the resultant diminished yields must be considered true yields for those years. The same applies in the case of varieties injured by storms, frosts, and other climatic causes. For example, it will be noticed that Firbank gave the lowest yield for grain in the early planting. This is due to the fact that Firbank, although of about the same season as Florence, and a slightly better grain yielder when sown in season, is much more sensitive to frost, and its yields were in several years reduced for this reason.

The following tables show the average yields for the period, exclusive of the year 1916, when the records were destroyed:—

GRAIN Yields.

Varieties in order of merit.	Years when grown.	Yield per acre based on percentage yield. bus.	lb.
	Early Planting.		
Yandilla King	1911, 12, 13, 15, 17, 18	27	38
Marshall's No. 3	1912, 13, 15, 17, 18	27	25
Bomen	1912, 13, 15, 17, 18	27	6
Warren	1911, 12, 13, 15, 17	25	41
Rymer	1912, 13, 15, 17, 18	25	20
Bobs	1911, 12, 13	24	54
Bayah	1911, 12, 13	24	47
Florence	1911, 12, 13	21	14
Zealand	1911, 12, 13, 15, 17	20	37
Federation	1911, 12, 13, 15, 17, 18	19	52
Hard Federation	1915, 17, 18, 21	19	18
Currawa	1915, 17, 18	18	47
Comeback	1911, 12, 13	18	37
Cowra 15	1915, 17, 18	17	44
Bunyip	1911, 12, 13, 17	15	26
Firbank	1911, 12, 13, 17	14	14
	Midseason Planting.		
Canberra	1915, 17, 18	23	28
Firbank	1911, 12, 13, 14, 17	22	57
Florence	1911, 12, 13	22	4
Bayah	1911, 12, 13	21	47
Warren	1911, 12, 13, 14, 17	21	25
Hard Federation	1915, 17, 18	19	57
Bobs	1911, 12, 13, 15	19	46
Federation	1911, 12, 13, 14, 15, 17, 18	19	21
Clarendon	1914, 15, 17, 18	19	7
Yandilla King	1911, 12, 13, 14, 15, 17, 18	19	4
Bomen	1912, 13, 14, 17, 18	18	54
Rymer	1912, 13, 14, 15, 17, 18	18	26
Comeback	1911, 12, 13	18	24
Marshall's No. 3.	1912, 13, 14, 17, 18	17	41
Bunyip	1911, 12, 13, 14, 17, 18	16	28
Zealand	1911, 12, 13, 14, 15, 17	16	1
Currawa	1915, 17, 18	15	34
Cowra 15	1914, 15, 17, 18	15	16
	Late Planting.		
Canberra	1914, 15, 18, 19, 21	24	7
Bunyip	1911, 12, 13, 14, 15, 17, 18	21	56
Bayah	1911, 12, 13	21	47
Rymer	1912, 13, 14, 15, 17, 19	20	29
Hard Federation	1915, 17, 18, 19, 21	20	27
Yandilla King	1911, 12, 13, 14, 15, 17, 19	19	57
Gresley	1918, 19, 21	19	53
Clarendon	1914, 15, 17, 18, 19	19	50
Federation	1911, 12, 13, 15, 17, 18, 19	19	17
Bomen	1912, 13, 14, 15, 17, 19	18	44
Warren	1912, 13, 14, 15, 17, 19	18	34
Comeback	1911, 12, 13	18	31
Firbank	1911, 12, 13, 14, 15, 17	18	25
Bobs	1911, 12, 13, 15	17	49
Currawa	1915, 17, 19	17	46
Marshall's No. 3	1912, 13, 14, 15, 17, 19	17	9
Zealand	1911, 12, 13, 14, 15, 17	16	45
Florence	1911, 12, 13	16	45
Cowra 15	1914, 15, 17	13	54
Commonwealth	1914, 15, 17	12	19

HAY Yields.

Varieties in order of merit.	Years when grown.	Yield per acre based on percentage yield. t.	cwt.	qr.
	Early Planting.			
Yandilla King	1911, 12, 13, 15, 17, 18	3	17	1
Bobs	1911, 12, 13	3	12	2
Zealand	1911, 12, 13, 15, 17	3	9	0
Bayah	1911, 12, 13	3	9	0
Warden	1917, 18, 20, 21	3	6	1
Hard Federation	1915, 17, 18, 21	3	6	1
Rymer	1912, 13, 15, 17, 18	3	6	0
Marshall's No. 3	1912, 13, 15, 17	3	4	2
Clarendon	1914, 15, 17	3	3	2
Federation	1911, 1912, 15, 17, 18	3	3	1
Firbank	1911, 12, 13, 17	3	0	2
Comeback	1911, 12, 13	3	0	0
Warren	1911, 12, 13, 15, 17	2	17	3
Florence	1911, 12, 13	2	16	2
Cowra 15	1915, 17, 18	2	11	3
Bunyip	1911, 12, 13, 17	2	8	0
Bomen	1912, 13, 15, 17, 18	2	5	2
	Midseason Planting.			
Canberra	1915, 17, 18	3	0	1
Hard Federation	1915, 17, 18	2	16	1
Zealand	1911, 12, 13, 14, 15, 17	2	14	0
Warren	1911, 12, 13, 14, 17, 18	2	11	0
Cowra 15	1914, 15, 17, 18	2	9	3
Yandilla King	1911, 12, 13, 14, 15, 17, 18	2	7	0
Rymer	1912, 13, 14, 15, 17, 18	2	6	3
Bobs	1911, 12, 13, 15	2	6	3
Clarendon	1914, 15, 17, 18	2	5	1
Marshall's No. 3	1912, 13, 14, 17, 18	2	5	1
Bomen	1912, 13, 14, 17, 18	2	4	3
Federation	1911, 12, 13, 14, 15, 17, 18	2	4	1
Firbank	1911, 12, 13, 14, 17	2	3	3
Florence	1911, 12, 13	2	1	0
Bayah	1911, 12, 13	2	1	0
Comeback	1911, 12, 13	2	0	0
Bunyip	1911, 12, 13, 14, 15, 17	1	14	2
	Late Planting.			
Canberra	1914, 15, 18, 19, 21	3	3	0
Gresley	1918, 19, 20, 21	3	1	1
Clarendon	1914, 15, 17, 18, 19, 20, 21	2	9	0
Cowra 15	1914, 15, 17	2	6	0
Firbank	1911, 12, 13, 14, 15, 17, 19, 20, 21	2	5	3
Hard Federation	1915, 17, 18, 19	2	3	2
Zealand	1911, 12, 13, 14, 15, 17, 19	2	3	0
Bomen	1912, 13, 14, 15, 17, 19	2	1	1
Bobs	1911, 12, 13, 15	1	19	3
Federation	1911, 12, 13, 15, 17	1	19	0
Commonwealth	1914, 15, 17	1	18	3
Warren	1911, 12, 13, 14, 15, 17, 19	1	17	3
Marshall's No. 3	1912, 13, 14, 15, 17, 19	1	14	1
Florence	1911, 12, 13	1	13	3
Bayah	1911, 12, 13	1	13	0
Currawa	1915, 17, 19	1	12	2
Yandilla King	1911, 12, 13, 14, 15, 17, 19	1	11	2
Rymer	1912, 13, 14, 15, 17, 19	1	11	2
Comeback	1911, 12, 13	1	10	2
Bunyip	1911, 12, 13, 14, 15, 17	1	8	1

EFFECTIVE Rainfall for the Years 1911–21.

Year.	Autumn (15th February—15th May).		Winter (15th May 15th August)		Spring (15th August—15th November).	
		Points.		Points.		Points.
1911	Normal	464	Normal	464	Dry	299
1912	Very dry	73	Very wet	1,009	Wet	691
1913	Normal	555	Dry	336	Normal	452
1914	Wet	590	Dry	298	Normal	332
1915	Dry	386	Wet	827	Wet	595
1917	Dry	303	Wet	785	Very wet	1,192
1918	Normal	494	Normal	560	Normal	403
1919	Dry	215	Dry	388	Normal	418
1920	Dry	345	Very wet	980	Wet	785
1921	Very wet	827	Wet	850	Normal	444

The summer rainfall (15th November to 15th February) was as follows:—1910–11, wet, 751 points, 31 wet days; 1911–12, normal, 615 points, 12 wet days; 1912–13, normal, 435 points, 16 wet days; 1913-14, dry, 303 points, 10 wet days; 1914–15, normal, 594 points, 6 wet days; 1915–16, normal, 407 points, 12 wet days; 1916–17, very wet, 860 points, 22 wet days; 1917–18, wet, 619 points, 16 wet days; 1918–19, very dry, 157 points, 9 wet days; 1919–20, wet, 634 points, 17 wet days; 1920–21, very wet, 814 points, 16 wet days.

Notes on the Varieties.

The following varieties have been tested for less than three years, and for the reasons given have been discarded:—

Cedar.—Strong flour wheat, but a poor yielder.

College Purple.—Weak flour wheat, yielding well in a good season, but with brittle straw, affected by wind at harvest time.

College Hunter.—Soft, weak, flour wheat. Far too late for the district.

Cowra 19.—Weak flour wheat. Medium yielder.

Genoa.—Medium yielder. Too late for this district.

Huguenot.—Suitable for silage and fodder. Not a milling wheat.

Huron.—Much too late for the district, and beards objectionable.

Improved Steinwedel.—Weak flour grain. Medium yielder. Inclined to shell.

King's White.—Heavy yielder of weak flour grain. Straw weak, and beards objectionable.

Lotz.—Very like Dart's Imperial. Not grown on account of low flour strength.

Major.—Weak flour wheat. Too late for district. Not very productive.

Marquis.—Too late Not very good yielder.

Minister.—Medium-strong flour wheat. Only moderately productive.

Penny.—Weak flour wheat. Heavy yielder in good seasons, but not so consistently productive as Yandilla King.

Roseworthy.—Scarcely distinguishable from Marshall's No. 3, which is retained in preference to it.

Walker's Wonder.—Very weak flour wheat. Droop head; prolific brown eared.

The following varieties have been tested for less than three years and are still under trial:—

Cowra 28.—Only fair yielder. Medium height; strong straw. Same season as Firbank.

Cowra 29.—A heavy grain yielder. Weak straw; medium height. Same season as Hard Federation.

Cowra 30.—A rust-resistant selection from Hard Federation. White ears. Promises to be a good hay variety.

Wandilla.—A medium yielder of grain or hay. Does not shell; strong straw. A few days earlier than Yandilla King.

The following varieties have been tested for more than three years:—

Bayah.—Very similar to Federation in grain and head. Discarded because not superior to Federation.

Bobs.—Strong flour. Moderate yielder. Inclined to shatter.

Bomen.—Good dual-purpose variety. Fair stooler; liable to frost. Midseason.

Bunyip.—A short-season grain variety. Weak straw. Replaced by Canberra.

Canberra.—An excellent short-season grain variety. Good stooler; tall, weak straw. Lodges if sown too early.

Clarendon.—Tough straw. Good hay variety. Same season as Firbank.

Comeback.—Strong flour, but only fair yielder, and discarded for this reason.

Commonwealth.—Does not suit this district. Very rust-liable.

Cowra 15.—Medium-strong flour. Strips well. Only moderate yielder.

Currawa.—Good grain variety. Short straw; fair stooler. Midseason.

Federation.—Heavy grain yielder. Good stooler; short, strong straw; liable to rust and mildew. Midseason variety.

Firbank.—Medium stooler; inclined to lodge. Excellent hay variety for late May and June sowing.

Florence.—Strong flour; medium stooler; rust-resistant. Splendid hay variety. About same season as Firbank.

Gresley.—A good dual-purpose variety. Medium stooler; tall straw Slightly earlier than Hard Federation.

Hard Federation.—Heavy grain yielder. Fair stooler; strong straw; drought-resistant. More disease-resistant than Hard Federation, and about six days earlier.

Marshall's No. 3.—Good dual-purpose wheat. Good stooler; tall straw inclined to shell.

Rymer.—Discarded on account of weak straw. Rather late for the district.

Waratah.—Fair yielder. Medium stooler.

Warden.—Fair grain yielder; splendid hay variety. Good stooler; tall growing. About ten days later than Hard Federation. Likely to replace Zealand as a hay variety for this district.

Warren.—Dual-purpose variety. Fair yielder. Rust-resistant. Midseason.

Yandilla King.—Very similar in appearance and season to Marshall's No. 3; slightly tougher to thresh.

Farmers' Experiment Plots.

MAIZE EXPERIMENTS, 1921–22.

Murrumbidgee Irrigation Areas.

A. N. SHEPHERD, Senior Agricultural Instructor.

EXPERIMENTS with maize for grain were conducted during the past season in co-operation with the following farmers:—

Mr. C. Eiper, Farm 1,421, Griffith.
Mr. R. Tiffen, Farm 319, Leeton.
Mr. A. Adams, Farm 528, Yanco
Mr. P. A. R. Gersbach, Farm 864, Stanbridge.

Although the demand for maize for grain is not a very big one on the Murrumbidgee Irrigation Area, the supplying of this demand should be productive of useful returns. Such returns should be especially useful in the case of farmers who are just establishing themselves, and particularly where the farmer has taken up land for orcharding. The earlier maturing varieties which are nowadays available to farmers should, moreover, encourage the cultivation of maize for the purpose mentioned.

Last season was notable for its low rainfall during the growing period (January to the end of March), only 126 points being registered, 64 points falling in January and the remainder in February. A fall of 280 points was registered in April, but too late to be of any use to the crops. The evaporation from a water surface for the three growing months was 22·171 inches. At the same time, it should be mentioned that the temperatures were not excessive, the maximum being 104·3 degrees on 17th February.

Details of the Plots.

Farm 1,421.—Good class, red sandy loam. Funk's Yellow Dent, used in manurial test, sown between young fruit trees on 6th December; grain dropped by hand at the rate of two every 2 feet in rows 3 feet apart. A splendid germination was obtained, the crop doing very well right through the growing stages. The plot was watered in all seven times. Yields:—Superphosphate, 70 lb. per acre, 68 bushels 48 lb.; M6, 112 lb. per acre, 58 bushels 36 lb.; no manure, 48 bushels 48 lb.

The mixture, M6, contains 5 parts superphosphate and 3 parts muriate of potash.

Farm 319.—Funk's Yellow Dent sown on land part of which had previously grown peas, part vetches; also on check plot of bare fallow. The green manure crops were ploughed under in October. Each plot was then further divided into two, one part being dressed with superphosphate at the rate of 70 lb. per acre, and the other left unmanured. Seeding was carried out by hand on 5th December. Although the land was in good condition at sowing time, a rather patchy germination resulted. The bare fallow land gave the heaviest returns. The crop received six waterings. Yields:—Bare fallow: Superphosphate, 70 lb. per acre, 30 bushels; no manure, 26 bushels 36 lb. Green manure (peas): Superphosphate, 70 lb. per acre, 27 bushels 18 lb.; no manure, 24 bushels. Green manure (vetches): superphosphate, 70 lb. per acre, 27 bushels; no manure, 23 bushels 18 lb.

Farm 528.—Old lucerne patch (red loam) used as manurial trial with Iowa Silvermine. Irrigated previous to sowing on 3rd December. Sown with corn-dropper at the rate of 10 lb. per acre in rows 3 feet apart. Dressed with M7 mixture at 70 lb. and 112 lb. per acre. A good germination resulted, the plants making satisfactory growth. Yields:—M7, 70 lb. per acre, 46 bushels 17 lb.; M7, 112 lb. per acre, 51 bushels 30 lb.; no manure, 41 bushels 44 lb.

The mixture M7 contains 10 parts superphosphate and 3 parts muriate of potash.

Farm 864.—Red sandy loam, previously cropped with peas, vines of which had been ploughed under. Sown on 13th December, with Iowa Silvermine and Shannon Vale Silvermine for comparative purposes. The Iowa Silvermine made much the more rapid growth and gave the heavier yield. It was noted that the Iowa type was characterised by a deeper grain, and that the stalks were much finer. The cobs were pulled in May and allowed to dry thoroughly before shelling. Yields:—Iowa Silvermine, 52 bushels 26 lb.; Shannon Vale Silvermine, 32 bushels 17 lb.

Lower North Coast.

J. M. PITT, Senior Agricultural Instructor.

MAIZE trials were conducted with the undermentioned farmers during the season 1921–22:—

A. R. Longworth, Ghinni, Manning River.
R. Richardson, Mondrook, Manning River.
G. Levick, Taree Estate, Manning River.
G. T. Clerke, Tinonee, Manning River.
S. Flett, Taree Estate, Manning River.
E. L. Andrews, Mt. George, Manning River.
H. Smart, Charity Creek, Manning River.
A. H. Norris, Mt. George, Manning River.
F. Waters, East Kempsey, Macleay River.
F. Kemp, Glenrock, Macleay River.
J. Booth, Temagog, Macleay River.
W. J. Adams, Gloucester.
T. H. Higgins, Gloucester.
J. G. Perrett, Miller's Forest, Hunter River.

Since the inauguration of the maize yielding contests in 1920, farmers' experiment plots have to some extent been superseded as an agency for the carrying out of maize improvement. These competitions are for the most part conducted with farmers' own varieties and strains, supplemented by a few non-competitive entries by the Department of Agriculture of varieties which are either not grown or grown to only a small extent in the district in which the contests are held, or of varieties of which the seed usually grown is of untrue type.

The experiment plots conducted by the Department have given valuable data concerning the best yielding varieties for certain districts, and although availed of to some extent, the results have not been utilised by farmers as fully as might have been wished. This has been mostly due to their smaller interest and perhaps less publicity by comparison with the maize yield contests, in which farmers compete with seed of their own raising. Large Red Hogan, for instance, which has yielded consistently well on coastal experiment plots, was but little grown by farmers on the Manning and on the Macleay previous to last season when it topped the yield in both contests.

In addition to the maize contests, however, a few experiment plots are being continued to test varieties in other centres, and earlier varieties which have little chance in the yield contests and which are nevertheless desired by farmers, their object being to obtain a variety that will yield moderately well and mature sufficiently early to catch the early market, and at the same time allow of the land being prepared for the sowing of a crop for winter fodder, such as field peas, vetches, barley, &c.

The Season.

The season was not a good one, the majority of the crops being adversely affected, some totally destroyed, by heavy rains and gales. First the heavy rains in late winter prevented ploughing operations, and this in turn delayed sowing operations. September rains caused faulty germination in places; then further heavy rains and gales in December had a disastrous effect on many plots, especially those at the tasselling stage. Many of the crops lodged, resulting in a high percentage of barren stalks. February rains and wind caused further lodging, and the number of mouldy cobs, especially among the bad tip-covered varieties, was high. The later ripening months were dry. Some of the crops, nevertheless, weathered the bad conditions well, and returned heavy yields.

The following table shows the rainfall, where the figures were available:—

Month.	Miller's Forest.	Mondrook.	Ghinni.	Kempsey.	Taree.
1921.	Pts.	Pts.	Pts.	Pts.	Pts.
September	90	333	415	265	397
October	441	348	409	319	480
November	362	163	86	138	165
December	453	609	786	382	738
1922.					
January	......	70	127	658	316
February	......	957	......	......	1,070
March	......	......	......	......	30

Notes on the Plots.

Ghinni.—Rather stiff loam; previous crop maize; ploughed twice before sowing; seed and fertiliser spread by hand, 10th November; land rather rough and damp. This is the second year in succession that Large Red Hogan has topped the 140-bushel mark on this farm. It was an exceptionally fine crop, and not damaged to any extent by adverse weather conditions. All the fertiliser sections gave substantial increases over the no-manure plot.

Mondrook.—Medium loam, cropped continuously with maize and broom millet; ploughed twice before sowing; seed, with superphosphate at the rate of 2 cwt. per acre, sown on 8th September. The crop was affected by rain badly in September, and again in December. Craig Mitchell (white) topped the list in its first trial on these plots; there were some exceptionally large cobs. This was followed by Giant White and Golden Beauty, two varieties grown largely by the farmer.

East Kempsey.—Rich alluvial loamy soil; maize grown for two years previously on the same section; land under cultivation for many years; ploughed twice before sowing on 30th September, 1921. Much interest was taken in this experiment, owing to the local early-maturing variety being pitted against other early varieties not previously sown in the district. Funk's Yellow Dent, maturing about the same time, showed an increase of about 9 bushels. Craig Mitchell, another early-maturing white variety, gave an increase of 28 bushels to the acre, and was only 3 bushels behind the later-maturing variety, Fitzroy. The majority of the yields were good.

Charity Creek.—Light loamy soil; previously cropped with maize and pumpkins for a number of years; ploughed three times before sowing on 21st December. Fitzroy easily outyielded the other varieties. The fertiliser, as on the Ghinni plot, was responsible for a substantial increase in yields. The sowing was rather late for the early-maturing varieties. but the yields were fairly good, rain and gales not doing much damage.

Miller's Forest.—Rather stiff loam; previously cropped with maize and lucerne; sown October. Plot covered by floods, and spoilt.

Mount George.—Light loamy soil; previously cropped with maize and pumpkins; ploughed deeply in August, harrowed and broken down; sown 23rd September; germination good. Plots badly affected by a dry, hot, spell at tasselling time, and then again by December storms. Local Dent turned out best, followed by Golden Beauty. This variety has yielded consistently well at Mount George for many years now.

The Gloucester plots were rain damaged, as were also many of those sown at Hannamvale. A pure seed plot of Coodra Vale, at Mr. S. Flett's property on Taree Estate, averaged about 100 bushels to the acre; a considerable portion was mouldy. Large Red Hogan, on a pure seed plot on Mr. G. Levick's property, Taree Estate, averaged over 120 bushels per acre. Early Morn, on a pure seed plot at Tinonee, promised well but was attacked by blight. Funk's Yellow Dent, on a pure seed plot at Mount George, averaged between 80 and 90 bushels, but became very weevily; it was sown too early for seed purposes, as was also a Craig Mitchell pure seed plot at Glenrock. The Temagog pure seed plot of Large Red Hogan was good.

Following are the yields in the variety and manurial trials:—

RESULTS of Variety Trials.

Variety.	East Kempsey, Macleay River.		Mondrook, Manning River.		Mt. George. Manning River.		Charity Creek. Manning River	
	bus.	lb.	bus.	lb.	bus.	lb.	bus.	lb.
Craig Mitchell ...	121	16	80	35	......		75	21
Manning Silvermine	112	25			.. ...		......	
Golden Superb ..	93	44	. . .		... ..		... ..	
Funk's Yellow Dent	102	35	.		......		......	
Yellow Moruya ..	. ...		.....		64	28	......	
Leaming	117	20	67	38	60	0	73	16
Hawkesbury Hogan ...	.....		... ..		61	28	......	
Golden Beauty ..	122	15	74	21	79	28	......	
Fitzroy ...	124	37	67	28	61	28	.....	
Large Red Hogan ..	122	15	67	48	64	28	84	0
Pride of Hawkesbury	..		71	54	58	28	.. ..	
Coodra Vale ...	...		50	19	66	0	..	
Early Clarence ..	. ..		50	45	......		.	
Narrow Red Hogan ...	. ..		70	0	48	0		
Golden Drop ..	.. .		60	10	60	0	.	
Manning Pride ..	... .		65	0	67	28	..	
Giant White ...	..		74	36	......		... ..	
Yellow Hogan ..	..		......		76	28	. .	
Iowa Silvermine	.. .		. ...		.. ..		66	0
Goldmine ..			......		.. ...		77	0
Eureka ...	..		. ..		......		56	24
Local Dent ...	.		.....		84	0	. ..	

RESULTS of Manurial Trials.

Manure per acre.	H. Smart, Charity Creek, (Fitzroy).		A. R. Longworth, Ghinni, (Large Red Hogan).	
	bus.	lb.	bus.	lb.
* M 5, 210 lb.	102	16	.....	
* M 6, 224 lb. .	.....		123	42
* M 7, 182 lb.	99	0	144	21
Superphosphate, 224 lb.	....		134	7
No manure	89	42	118	21

* M 5 mixture consists of superphosphate 2 parts, and sulphate of ammonia 1 part; M 6 of superphosphate 5 parts, and chloride of potash 3 parts; M 7 of superphosphate 10 parts, and chloride of potash 3 parts.

ALTHOUGH the European Corn Borer (***Pyrausta nubitalis***) has not yet been recorded in Australia, this moth has proved such a serious pest in maize crops in other countries that it cannot be overlooked. Additional quarantine precautions are therefore desirable with regard to those products in which it is most likely to be introduced.—W. W. FROGGATT, Government Entomologist.

Natural Crossing—a Danger in Growing Seed Wheat.

J. T. PRIDHAM, Plant Breeder.

SOME farmers are finding it profitable to grow wheat for seed, giving careful attention to fallowing and clean farming, as well as to clean machinery and to the avoidance of mixing of varieties. But in spite of all due care in these directions the phenomenon of natural crossing is a source of impurity not sufficiently allowed for. This has been remarked before in this journal, but it requires emphasising, because in some quarters its occurrence is discounted, if not denied Howard, in India, has recorded very many instances, and we have found most of our standard varieties in this State becoming impure by this means. Individual plant selection thus becomes more than ever necessary, and we employ the three best individual plants of a variety to raise three small increase-plots for pure seed propogation. If each of these three bulks is sown separately next season, any departure from type in the crop can be seen, though the system should be carried one season further, three bulks again being sown and larger plots of each strain obtained in order to furnish seed for larger areas.

A natural cross does not show itself the first year—the season when cross-pollination takes place. Even the next year the grain produces plants but little different from the original mother. In the third season, however, decided variations appear, and these multiply as long as this seed continues to be used year after year. Only, therefore, by continuing selection along individual lines into the third season can the Department safeguard the purity of the seed supplied from the experiment farms to farmers, and it would be well for progressive men to follow a similar system on their own farms if they are going in for the seed business. They will find the little extra trouble will pay handsomely.

An instance came under the writer's notice recently in which a grower of seed wheat found that his seed of a certain variety obtained during the current season from a Government farm was pure, but that the crop of that variety raised from seed originating from that farm two years back, was impure. Though one cannot say authoritatively, it appears extremely probable that the variations found are due to natural crossing rather than to admixture of two varieties.

Two cases in point have occurred this season on one of the experiment farms. Two bulks of each of two varieties were sown separately, and one sowing of each contained a considerable admixture of off-type plants, the whole bulk in each case having to be rejected. The other sowing of each variety, originating from a different selected plant, had remained pure, and the crop was sufficiently even and true to type for seed propagation. No admixture of seed had occurred.

In some seasons the climatic conditions favour the phenomenon, especially dry and hot weather at the flowering time. In the United States of America the trouble is common in certain States, while in others, especially on the Atlantic side, it is quite rare.

There are unimportant variations in varieties of wheat, such as a trifle more or less tip awn than normal, a slight fulness or crowding of the tip, a purpling or absence of colour in the straw, an abundance or the reverse of flag, but these are all inconstant variations only due to season or environment. Where, however, the crop presents an uneven appearance, some plants being greener than others, more vigorous, different in form of ear, or different in ripening period (this being the most marked feature), the crop may be set down as the victim of natural crossing, provided, of course, no mechanical admixture of seed before sowing has taken place.

CONCERTED ACTION CAN CONTROL GRASSHOPPER PLAGUES.

The larger plague locust (*Chortoicetes terminifera*) again appeared in plague numbers during September of last year. Mr. T. McCarthy, Assistant Entomologist, was immediately sent to the Hunter River Valley (the plague centre) to urge landowners to spray. He found that, notwithstanding the repeated warnings of the Department of the possibility of invasion, little effort had been made to meet it. Mr. McCarthy addressed meetings at a number of centres, established "grasshopper committees" at each, and outlined a scheme of action on which to work, 2,000 leaflets on the spraying of grasshoppers being urgently printed by the Department, and despatched to the various committees for distribution.

The Hunter River Valley was again visited in the following March for the purpose of estimating the value of the work done, when Mr. McCarthy reported that the results were very satisfactory, and indicated that with more effective co-operation grasshopper invasions in the Hunter River Valley could always be controlled, and perhaps entirely prevented. It is pleasing to record that the organising work suggested by Mr. McCarthy, and carried out by the grasshopper Committees, has stimulated interest in the work of grasshopper destruction, and has caused a much wider recognition among landholders of the value of united action in such circumstances, and of the efficacy of spraying with arsenite of soda as a control measure. Extensive spraying was carried out, and this so limited the second hatching, that such grasshoppers as did hatch were easily controlled by starlings and other natural influences.—W. W. Froggatt, Government Entomologist, in a recent report.

NEW VARIETIES OF OATS.

The success attained by the Department in the raising of oats suitable for all the districts in which wheat is grown is of very great importance to farmers, providing as it does, a change of crop which is of considerable importance in combatting take-all. The sowing of oats in rotation with wheat has been recognised as a means of overcoming this disease, and the new varieties under discussion promise to provide profitable yields under climatic conditions unfavourable to the older ones.—J. T. Pridham, Plant-breeder.

Yellow versus White Maize as Food for Stock.

H. WENHOLZ, B.Sc.(Agr.), Special Agricultural Instructor.

FOR many years the opinion has been held in New South Wales that yellow maize is superior to white for feeding stock, and the question is often referred to the Department by farmers for advice. There always has been, in this State at least, a marked preference by buyers of maize (particularly in Sydney for horse and poultry) for the yellow kind, and this has been reflected in the price per bushel. Although this difference was much greater a decade or two ago than it has been in recent years, the closer approximation of the price of white maize to that of yellow has not been due to any considerable change in the opinion of buyers. It has been due rather to the fact that white maize is much more in demand for manufacturing purposes (cornflour, starch, glucose, &c.), owing to the great extension of these industries in Australia, and also to the fact that South Africa, thanks to an efficient system of grading and inspection for export maize, has been placing a much higher quality of white maize (chiefly Hickory King variety) on our market than formerly.

The opinion still exists, then, among buyers for horse and poultry feeding that yellow maize is superior in feeding value to white, and this discrimination leads to the common spectacle of white maize being quoted at 2d. or 3d. per bushel less than yellow. However, a few of the largest city carrying companies, who are the biggest buyers of maize for horse feed, do buy white maize, and apparently get better value for the cheaper price. The largest proportion, nevertheless, prefer yellow maize, and willingly pay the extra price for it. How, then, can this anomaly be explained, and who is right? It is only within very recent years that a sound explanation has been forthcoming to show that under some circumstances the city buyers of yellow maize were the more likely to be correct.

Feeding Value Influenced by Richness of Soil.

Some years ago the chemist's branch of the Department analysed samples of maize of the same colour (yellow) grown on rich and poor soil respectively, and it was shown that by chemical composition the maize grown on rich soil had a higher feeding value than maize grown on poor soil. Now, seeing that white maize (especially Hickory King) has a better yielding reputation on poor or moderately fertile soil than yellow maize, much of it was undoubtedly grown under these conditions, and it would therefore have, generally speaking, a lower feeding value than yellow maize which was grown on the richer soils. On chemical analysis, then, yellow maize was superior to white for feeding, and it is also likely that in actual feeding the results obtained from the feeding of yellow maize were better than those obtained from white, thus justifying, to some extent, the difference in price. By the conspicuous absence of feeding tests from the work of the Departments of Agriculture generally in Australia we suffer one great disability in making the final decision of this point, for chemical analysis takes no cognisance of digestibility, palatability, and other factors which determine the true value of a feeding stuff. But, assuming chemical analysis to be some guide, it would appear that if the above conditions of soil were to obtain largely, yellow maize could be regarded as superior to white.

It cannot be laid down, however, that all white maize would be grown on the poorer soils, for it is now known that the oft-quoted opinion that white maize is better for poor soils than yellow is not broadly true. It may be true for one or two white varieties (particularly Hickory King and Iowa Silvermine), but it is not a fact in relation to all white varieties. Boone County White, for instance, and the new variety Craig Mitchell are white varieties which abhor poor soil, and in fact so much do they prefer rich soil that they yield better than many yellow varieties on such fertile soil. Again, many farmers persist in growing Hickory King on good soils, to their own loss no doubt, for in nearly every case it can be shown that some yellow or red variety of maize will outyield this variety on rich soil. But in such cases, where these white varieties are grown on very fertile soils, they will analyse better than yellow varieties grown on less fertile soils, and we should find that on chemical analysis this white maize has a better feeding value than such yellow maize.

Vitamines now Explain Difference.

In spite of chemical analysis, however, only actual feeding tests afford reliable information on the subject, and from these feeding tests other conclusions can be drawn, especially in recent years, since the "discovery" of those yet somewhat indefinable substances, the vitamines.

It may be well first to explain shortly what these vitamines are, or at least to explain the significance of their occurrence in foods and feeding stuffs. Previous to the enunciation of the vitamine theory (within the last decade) it was thought that so long as feeding stuffs contained protein, fats, carbohydrates, and mineral matter in sufficient quantity and in the right proportion, they satisfied all requirements. It is now known that, however large and varied the feed may be, it fails to produce normal growth unless it contains certain specific substances—the vitamines. Three, and possibly a fourth, of these substances have been identified by their physiological action. It is not strictly correct to say they have been discovered, because their chemical nature is still unknown, but plants and feeding stuffs have been studied assiduously by *feeding tests* in recent years to determine the presence or absence respectively of these "growth factors" by their function on animal life and well-being. The question of the presence of these vitamines in the foods of man, and their general effect on his health, will not be dealt with here, but rather their presence or absence and their action in feed stuffs for stock.

Vitamine A is particularly necessary for young growing stock. Without it young animals not only stop growing, but become susceptible to diseases such as rickets, catarrh, and tuberculosis. This vitamine is contained abundantly in green feeds, pastures (especially of leguminous plants like lucerne and clover), and whole milk, and moderately in skim milk and buttermilk. *Yellow maize contains some, while white maize contains practically none.*

Vitamine B is of greater importance in the nutrition of man than of stock. In human beings its lack causes nerve trouble, partial paralysis, and the Oriental disease known as beri-beri. Farm stock are not likely to suffer from its lack in feeding stuffs unless they are deprived of grain, in which it is contained in large quantities, more particularly in the bran (seed coat) and germ of the seed.

Vitamine C, the absence of which causes scurvy, is found abundantly in fresh fruits and vegetables for man, and is probably contained in sufficient quantity for stock in pasture and lucerne hay, while it is deficient in grains and usually in concentrated feed stuffs, such as oil meal, bran, &c.

Vitamine D is practically unknown in its relation to stock at present.

It is the presence of Vitamine A in yellow maize, and its almost total absence in white maize, which now throws more light on the difference in the feeding value of these two grains to stock.

Feeding Experiments with Stock.

Reference has been made to the paucity of data from feeding experiments with stock by Departments of Agriculture in Australia, but fortunately we are able to draw usefully from America in this regard, and on this very question the data available would be almost entirely applicable to Australia. It was not until 1920 that Dr. Steenbock, Agricultural Chemist in the University of Wisconsin, found in feeding trials with rats that yellow maize was much richer in Vitamine A than white maize. The Animal Husbandry Department of the above University then took up the question with stock, and, while it was not thought that any difference would be observed with other farm stock consuming a good quantity of pasture or lucerne hay (which are both rich in Vitamine A), it was expected that there might be a difference in the value of yellow and white maize for pigs which were fed in a dry lot without access to pasture. And so it proved. In 1920* pigs self-fed a balanced mixture of yellow maize and tankage (meat meal) gained 1·59 lb. a head daily, requiring 423 lb. feed for 100 lb. gain, while pigs self-fed a mixture of white corn and tankage gained only 1·13 lb., and required 16 per cent. more feed for 100 lb. gain in weight.

Later trials† showed that yellow maize produced decidedly larger and more economical gains than white maize when fed to pigs not on pasture, with supplements such as skim milk, whey, or linseed meal, none of which are high in the Vitamine A. For pigs on excellent pasture there was no difference between the value of yellow and white maize, owing to the fact that green plants are rich in this vitamine.

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* Wisconsin Sta. Bull., 223 (1921). † Wisconsin Sta. Bull., 339 (1922).

At first pigs on white maize and skim milk did practically as well as those fed yellow maize and skim milk, but ultimately the lack of the Vitamine A in their ration produced serious results, and finally five pigs out of eight died. The common cause of death seemed to be either rickets (paralysis or rheumatism) or pneumonia, which agrees with results secured in experiments with rats, in which it was found that a deficiency of the Vitamine A often produces death from respiratory troubles, especially pneumonia.

The advice is given in the same publication that if yellow maize is available white maize be not used for feeding pigs in winter in dry lot; and that if white maize must be fed to pigs in dry lot, to see that they get some bright green lucerne hay or hay from other legumes. Young pigs cannot make good use of much hay, even if it is of the best quality, so that they may not make quite as good gains as if they had been fed yellow maize.

Conclusions.

Colour in maize would undoubtedly appear to be significant in relation to its feeding value, and actual feeding tests suggest that yellow maize, by reason of some association between colour and vitamine content, has a more complete nutritive value than white maize under certain conditions.

It would seem to be well proved that for all stock white maize is not inferior to yellow when abundant pasture or lucerne or leguminous hay is available, but when such is not the case, then yellow maize would be superior to white. For farm horses with ready access to pasture or lucerne or clover hay, white maize would be equal to yellow, but for city-fed horses, where oaten or wheaten chaff or lucerne chaff of poor quality supplies the bulk, and where pasture is not available, yellow maize would be superior to white. The same might apply to poultry at those seasons of the year or under those conditions when green feed is scarce. It is a well-known fact that green feed, or to a lesser extent yellow maize, enriches the colour of the yolk of the eggs, while white maize, together with absence of green feed, causes a pale colour in the yolk. Thus, in view of the probable connection of colour with vitamine content, it would appear that a significant suggestion to poultry-farmers can be made. With the production of pale-coloured yolks in the eggs, it seems that it might be assumed that the fowls are not getting the essential growth factors in their feed for successful nutrition; that this deficiency of vitamine, as evidenced in the eggs produced, would be reflected later in the health, development, or productive capacity of the birds; and that colour deficiency may be regarded as a timely warning to correct the feeding by supplying the essential vitamine either in green feed or yellow maize.

As in previous years, a great deal of work has been undertaken for farmers, orchardists, and horticulturists in connection with fungus and bacterial diseases of plants. Numerous specimens have been examined, diseases identified, and, following on diagnosis, practical advice regarding disease control has been furnished. . . . . . The care and attention given to this work is having a noticeable effect in the greater knowledge which our growers are displaying in disease control.—G. P. DARNELL-SMITH, Biologist, in a recent report.

The Production of Peanuts.

A NEGLECTED INDUSTRY.

W. D. KERLE, Senior Agricultural Instructor.

WHILE the question of profitable side-lines is occupying the minds of farmers, the claims of the peanut to serious consideration should not be overlooked. It is readily admitted that as a source of national wealth it cannot be compared with any of the staple crops, and the general public are perhaps apt to regard it only as the roasted article associated with the plaintive cry, "Peanuts, a penny a bag"; but in reality there is hardly any limit to the range of uses to which the crop can be put. Professor Carver, Chief of the Research and Experiment Station at Tuskegee Institute, United States of America, recently exhibited at Washington, D.C., over a hundred varieties of products from peanuts, amongst which were oils, meals, milk, butter, flours, breakfast foods, relishes, sauces, flavourings, confections, prepared nuts of many varieties, various forms of stock foods, and even wood stains, face powder, face cream, and ink.

Peanuts, however, are of most interest to us at present as nuts for roasting, and for the confectionery and oil trades, while the plant itself is of great value as a soil renovator and as food for all classes of stock.

Some idea of the importance of the peanut can be gathered from statistics of the industry in the United States. Although it was introduced into that country in the early days of settlement, its commercial importance was first recognised only some fifty years ago, and the development of the industry (particularly in the last ten years) has been little short of phenomenal. In 1889 nearly 4,000,000 bushels of nuts were produced, in 1911 three times that quantity, and in 1917 40,000,000 bushels were harvested. Since that year the output has still further increased, and the area under the crop now exceeds 2,000,000 acres per annum. With regard to peanut oil, the United States consumed in 1916 nearly 6,000,000 gallons, one-half of which was produced in that country. European countries are very large consumers. France uses annually some 16,000,000 gallons of edible oil, and 23,000,000 million gallons of low grade for soap manufacture, &c., while Germany imported some 6,000,000 gallons of edible oil under pre-war conditions.

Protection for Local Growers.

The oil imports of the Commonwealth of Australia are given as 107,742 gallons in 1919, 47,820 gallons in 1920, and 58,966 gallons in 1921. With regard to the nuts, over 150,000 bushels, worth approximately £30,000, are imported—chiefly from the East.

In a country so well adapted for peanut culture as Australia, we should be growing all that is required for our own use and exporting large quantities

overseas. The tariff recently imposed by the Commonwealth on imported nuts and oil is considerable, and affords a very substantial protection to local growers. It is as follows :—

Peanuts in the shell, from the United Kingdom	...	2d. per lb.
„ „ other British countries	...	3d. „
„ „ foreign countries	...	4d. „
Shelled peanuts	...	6d. „
Peanut oil, from the United Kingdom	...	2s. per gallon.
„ „ other British countries	...	2s. 6d. „
„ .. foreign countries	...	3s. „

Competition with eastern countries has been a much harder problem in the United States, as will be readily understood by the following interesting comparison with the Australian tariff :—

	Per ton £	s.	d.
Peanuts in the shell, Australia...	37	6	8
„ „ United States	1	14	6
Kernels in the shell, Australia...	56	0	0
„ „ United States	3	9	0

That there are large areas of land eminently suitable for the production of first-class nuts, particularly in Queensland and New South Wales, is beyond doubt. Experiments conducted by the Department of Agriculture have demonstrated the possibility of high yields. At Grafton Experiment Farm a yield of 124 bushels was obtained in 1913 and 121 bushels in 1915; at Yanco Experiment Farm in 1915 one variety yielded 107 bushels and another 118 bushels. More recently Mr. Wm. Barnes, South Woodburn, Richmond River, co-operated with the Department in a trial on his farm of artificial fertilisers with White Spanish peanuts. The sowing was made on 10th November, 1921, on a light grey sand of poor quality, which had been cleared of ti-tree and bracken fern just previous to planting, and had only received one ploughing. The crop was harvested on 9th May, after a favourable season, in which 25·20 inches of rain fell in the growing period. The results obtained were :—

	bus.	lb.
With 3 cwt. P7 (equal quantities of superphosphate and bonedust) per acre	122	10
With 3 cwt. superphosphate, per acre	103	6
Without fertiliser, per acre ...	110	14

The American standard bushel weight of peanuts is 22 lb., but the small white Spanish variety weighs 30 lb. to the bushel. The highest yield in this trial estimated at the latter weight per bushel yielded 1 ton 13 cwt. nuts per acre- a yield which, under the circumstances, was remarkable.

The Question of Market.

The question of the market for peanuts has always been the stumbling block to the industry in Australia. The 150,000 bushels imported annually from China and Japan arrive perfectly graded, clean and bright, and local growers must be prepared to market their products in like manner. The imported nuts are used practically wholly for the roasting and confectionery trade, but there is being erected in Sydney an oil mill capable of handling

2,000 tons of nuts annually. This enterprise may mean the setting on its feet of the peanut industry in this State. When the plant referred to is in working order, peanuts received will be divided into three grades, namely, (1) for confectionery purposes, (2) for the roasting trade, and (3) for oil expression.

In the first two grades local growers will compete with the Oriental product, but will have the substantial advantage of the protective tariff mentioned. To successfully compete with oil from other countries the price of nuts for oil will be regulated by the price of the imported article. This grade, however, provides an outlet for the grower for the small, undersized, broken, and stained nuts quite unsuitable for the other grades, although, of course, utilizable on the farm for all classes of stock.

Varieties.

One of the chief essentials to success in undertaking peanut growing for the trade is the selection of the right varieties. In this State the choice is unfortunately very limited; indeed, beyond the Chinese variety, Valencia and White Spanish, we have none worthy of consideration. These, however, have their own particular uses. The Valencia, a medium-sized pod containing three to five tightly-packed, dull-red nuts of excellent flavour, is much favoured by the confectionery trade; samples grown at Grafton Experiment Farm, submitted to a Sydney firm, have been pronounced "equal in flavour to the best imported nuts" for roasting. The Chinese variety contains two large-sized nuts of light-brown colour; this is the sort one buys when purchasing the roasted article. The White Spanish is a small-podded variety, containing two light-brown coloured nuts completely filling the pod. It is early maturing, hardy, and usually gives high yields; it contains from 7 to 10 per cent. more oil than any other variety, and for this reason is particularly suited for the oil trade. The flavour of this nut is very little, if at all, inferior to the other varieties, and, as a matter of fact, the variety is largely used in America for confectionery purposes also.

General Conditions.

Peanuts require a light, sandy soil, if large nuts of bright appearance are to be obtained. The crop exhibits remarkable drought-resistant qualities, but is not injured, on the other hand, by excessive falls of rain provided drainage is good. In fact, very satisfactory yields have been obtained in Queensland in districts where over 100 inches have fallen during the growing period.

Beyond a leaf-spot fungus (probably *Cercospora personata*), nothing in the way of pests and disease has been recorded in this State. In America, too, serious insect or fungus troubles are unknown.

Detaching peanuts from the vine by hand is a tedious and costly operation, particularly in Australia, where no cheap labour is available. In harvesting peanuts the whole plant is taken up, left some time to cure, and then stacked. After the nuts are detached the vines form a very valuable fodder for stock, almost equal in feeding value to lucerne hay, the comparative nutritive ratios being 1 to 6 and 1 to 3·9 respectively.

Conclusion.

The reasons why the peanut industry should be developed very considerably in Australia may be enumerated as follows :—

1. A good market exists locally for peanuts for all branches of the trade.
2. We are at present importing an article which we can produce locally and of equal quality.
3. We have large areas of suitable land and ideal climatic conditions.
4. A substantial protective tariff for nuts and oil has been recently imposed constituting an offset to any comparatively high cost of production due to greater price of labour.
5. The crop has a wonderful variety of uses commercially, and as a stock food and soil renovator on the farm.
6. Machinery for the harvesting, cleaning, and grading of the crop, and for the expressing of its oil, &c., is used very extensively in the United States, and the importation of such machinery by co-operative effort is quite feasible. The establishment of co-operative peanut factories for the manufacture of oil and by-products is probably the surest means of setting up this industry locally, and giving peanuts the place in our primary products they deserve.

WHEN POTATOES ARE FROSTED.

LITTLE can be done to help a potato crop that has been cut by frost, though it does not necessarily follow that because a crop has been frosted it must be a failure. Much, of course, will depend upon the severity of the frost and the period at which the crop has been caught. In the case of late frosts, it is usually found that, even if the whole of the top-growth is destroyed, no damage results below the ground level, fresh shoots then being allowed to come away from the main stem. Such second growth may be dwarfed, but, under favourable conditions, it will still be capable of producing a satisfactory yield.—A. J. PINN, Special Agricultural Instructor.

THE INESTIMABLE VALUE OF CLOVERS.

As an adjunct to pastures, clovers are of inestimable value in this State. In the coastal districts white clover has increased the productiveness of couch, paspalum, and other grasses to a very great extent. The manner in which it will grow in the poorest of soils is particularly noteworthy, while on the rich volcanic soils of the northern rivers it provides the necessary supplementary constituent to complete the ration. In the interior, particularly in the south-west and Riverina, ball and woolly clovers are very abundant, often dominating the situation. Their capacity to fatten lambs in the spring is well known.—J. N. WHITTET, Agrostologist.

Field Experiments with Sweet Potatoes.

Grafton Experiment Farm.

A. W. S. MOODIE, Experimentalist.

IMPORTED varieties of sweet potatoes from the United States and Queensland were tested out during the season 1921–22 against the local variety, Pink. Of the American varieties, Triumph, Nancy Hall, Southern Queen, Porto Rico, and Yellow Strassburg had been the subject of trial the previous season, when Triumph proved the heaviest yielder, followed closely by Porto Rico and Yellow Strassburg. In the 1921–22 trials there were added the varieties Goldskin, Red Carolina, Red Bermuda, White Yam, and Georgia.

The trial area was situated on red volcanic soil, on a block which had not been cropped for some years. It was found, however, that such soil dries out too quickly after rain, and sets too hard for the best results from this crop.

For the propagation of the sets fresh stable manure was placed in a frame to a depth of 4 inches, and covered with about 3 inches of light sandy soil. The tubers were then placed on top of this, close together, but not touching, and the whole covered with 2 inches of the sandy soil. This operation was carried out on 15th August, 1921. The trial area was ploughed in August to a depth of 9 inches, harrowed, rolled, and harrowed again. It was reploughed and harrowed down on 6th October. Planting was carried out on 28th October, drills being opened up with the plough, 3 feet apart, and the young plants placed every 2 feet in the rows. The succeeding furrow covered the roots, which were then firmed down with the foot.

Although all the plants were of good size (8 or 9 inches long) germination was not as even as was expected, the later imported varieties suffering in this regard. The soil was in a good moist condition at time of planting, but during the next month only 135 points of rain were registered, whilst temperatures ranged up to 105 degrees, and in some varieties misses were numerous. Cultivation between the rows was carried out until the thickness of the vines made it impossible. The established plants made splendid growth, although in some cases where vine growth was most vigorous the least number of tubers were found. The rainfall over the growing period was as follows:—November, 135 points; December, 689; January, 22; February, 982; March, 83. Total, 19·11 inches. Harvesting was delayed owing to the pressure of other-work, and did not take place until 6th June, but the tubers were in excellent condition, without sign of second growth. The yields were as follows :—

Variety.	Yield per acre based on percentage.				Variety.	Yield per acre based on percentage.			
	t.	c.	q.	lb.		t.	c.	q.	lb.
Triumph	9	7	2	0	Red Bermuda ...	3	2	0	26
Southern Queen ...	7	9	2	16	White Yam	1	4	2	25
Yellow Strassburg ...	6	0	2	14	Goldskin	1	2	2	25
Nancy Hall	4	6	0	6	Red Carolina ...	0	15	1	5
Porto Rico	3	5	1	26	Georgia	0	3	0	9

The checks of Pink averaged 5 tons 8 cwt. 22 lb.

Of the later batch of American varieties, Bermuda is the best yielder; patchy germination affected its showing in these trials. This variety is almost indistinguishable from the local variety Pink. Following are notes on the characteristics of imported varieties not previously described.

Red Carolina.—Deep red; tubers very small (about 4 inches long and 2 inches thick). Fair table variety and a good keeper. The germination of this variety was poor, but individual plants did not yield as well as in the varieties by which it was beaten in bulk yield, though it made vigorous growth.

Goldskin.—Tubers small, and golden in colour. A smooth-skinned and attractive table variety. The germination of this variety also was poor. It is a much better yielder than the figures indicate.

Georgia.—A small white variety with good appearance. Vine growth rather light. A good table variety.

Wollongbar Experiment Farm.

J. DOUGLASS, **Assistant Experimentalist.**

TRIALS of a number of varieties of imported sweet potatoes were carried out at this farm last season with the object of comparing them with Queensland and local sorts. The imported varieties (from the United States) were Yellow Strassburg, Southern Queen, Triumph, Porto Rico, Nancy Hall, Red Carolina, Red Bermuda, Goldskin, Georgia, and White Yam.

The experimental area had previously been occupied by a crop of garden peas, the residue of which was ploughed under on 19th October, 1921. The land was harrowed twice on 21st October, and disc-ploughed on 13th December, and harrows were subsequently used to produce a good seed-bed. The plants were dibbled in with a spade on 19th December; they were set 2 feet apart in drills 3 feet apart, without manure. Heavy rains fell during the end of December and gave the plants a good start, there being very few misses. A long, dry spell during the autumn had a detrimental influence on the crop, a few of the American varieties suffering badly, as shown by the yields obtained. The top-growth was not as heavy as in previous years. The total rainfall over the growing period was 4622 points. Harvesting took place on 10th July, when the following yields were obtained :—

Variety.	Yield per acre based on percentage.	Variety.	Yield per acre based on percentage.
	t. c. q lb.		t. c. q. lb.
Pink Fiji	13 17 3 3	Southern Queen ...	8 19 2 12
White Fiji	12 17 0 11	Nancy Hall	8 17 2 14
Pierson	12 16 0 19	Porto Rico	8 16 1 16
White Yam	12 4 3 0	Yellow Strassburg ...	7 8 2 14
Red Bermuda	11 1 1 5	Triumph	6 5 3 20
Cattle	9 18 3 2	Georgia	5 15 1 3

The checks of White Maltese averaged 7 tons 14 cwt. 1 qr. 8 lb. Goldskin and Red Carolina practically failed, only a few pounds of each being harvested.

Pink Fiji is very well adapted to local (district) conditions. It is a good table variety, with large uniform tubers.

White Fiji also has uniform tubers. A good keeper.

White Yam is a very good yielder, with large, rounded, yellow-fleshed and rather coarse tubers.

Cattle makes heavy to-growth. Its tubers are coarse-fleshed and very similar to White Maltese in shape and growth.

Hawkesbury Agricultural College.

B. M. ARTHUR, Experimentalist.

ELEVEN varieties figured in the sweet potato trials carried out at Hawkesbury Agricultural College last season, an area of approximately half an acre being planted out on 28th October, 1921, to potatoes which had been propagated in a suitable hotbed since the beginning of the previous August. The rooted cuttings were planted in rows 3 feet apart in each direction, thus enabling cultivation to be carried out both ways. The ground, a clay loam, had been well prepared and was in good order, containing sufficient moisture to ensure satisfactory progress during the early stages of the plant's growth. When the tubers commenced to form, however, and moisture was most needed, rain was conspicuous by its absence, and consequently yields were low. The rainfall received during the growing period from November to May was 1,446 points.

Digging was commenced early in June, and continued to the middle of July, when operations had to be suspended for three weeks owing to the heavy flood rains water-logging the ground, causing a number of the tubers to rot, and delaying the digging of the balance. The yields were as follows, a small quantity of each variety being left for seed purposes.

Variety.	Yield per Acre	Variety.	Yield per Acre.
	t. c. q. lb.		t. c. q. lb.
White Maltese	9 10 1 25	Big-stem Jersey ..	4 7 2 0
Yellow Strassburg ...	8 9 0 5	H.A.C. Pink (2 plots)	4 6 0 17 2 18 3 9
Triumph	6 13 3 20	Pierson	4 4 2 25
Southern Queen ...	6 7 0 9	Nancy Hall	4 0 1 12
Porto Rico	4 9 1 0	Small-stem Jersey ...	2 17 0 16

A yield of 7 tons was obtained on a plot devoted to Red Jersey, but as among the small elongated tubers produced by this variety were a quantity of H.A.C. Pink, the yield cannot be regarded as accurate for comparative purposes.

LEGUMES AND THEIR NITROGEN CONTENT.

THERE is, unfortunately, an impression among farmers that if the leguminous crop is removed from the land and the roots with their nodules remain, the soil is thereby enriched in nitrogen. It must be clearly understood, however, that the nitrogen taken from the air by the organisms does not exist in the nodules, but is made use of and distributed throughout the plant, and that the removal of the above-ground portion of the plant from the land means the removal of a large amount of nitrogen. An increase in the nitrogen content of the soil can only result from the growing of leguminous crops when they are either fed off, ploughed in, or soiled to stock and the resultant manure from the stock returned to the soil.—H. WENHOLZ, B.Sc.(Agr.), Special Agricultural Instructor.

TO ERADICATE CAPE TULIP.

SMALL patches of Cape tulip can be successfully got rid of by digging out the plants before they have flowered or set their seeds. If, however, there is any ripe seed on the plants before digging operations are commenced, it should be carefully removed, so as to prevent it being scattered about the ground. Land badly infested with the seed can only be properly cleaned by two or three years' cultivation, as much ploughing and harrowing being given as can be afforded, In rough and stony land digging and hand-picking seems to be the only resort.

All parts of the plant should be burnt, as the leaf sheaths often protect the young bulbs, which soon develop into plants if allowed to do so. The Cape tulip is well authenticated as a plant poisonous to cattle.—W. F. BLAKELY, National Herbarium, Botanic Gardens.

Insect Pests of the Cultivated Cotton Plant.

No. 1.—The Noctuid Moths belonging to the Genus *Earias*.

WALTER W. FROGGATT, F.L.S., Government Entomologist.

COMMERCIAL cotton is obtained from the mature seed capsules of a number of different species of the shrubby plant from which the commodity takes its name. All species are included in the genus *Gossypium*. This group belongs to the family *Malvaciæ*, which contains among others the marsh-mallows, the hollyhocks, and the beautiful flowering hibiscus. Some of the latter are so closely related that several are known as "wild cotton" because their seed capsules form small bolls.

Among the indigenous plants of Australia there are thirty-eight species of hibiscus, described from over the whole continent. Of these, thirteen species are found growing in New South Wales, and eight species of the genus *Gossypium* are listed by Baron von Mueller as native to Australia. It will, therefore, be reasonable to expect that the insect fauna of these plants, plants so closely related to to the commercial cotton plants, will sooner or later turn their attention to our cotton fields when commercial cotton is planted in those paddocks where any of these species grow under natural conditions. It will only be history repeating itself. The Colorado beetle of the Rocky Mountains deserted its native food-plant for the more succulent potato foliage, and it followed it up across the United States. To come nearer home, the Queensland sugar cane beetle (*Lepidoderma albohertum*) originally fed upon grass roots; it turned its attention to the invading grass-like roots of the allied sugar cane, and has become a most serious pest of the sugar cane.

The more cotton that is planted, the greater will be the food supplies for the boll-feeding moths and beetles that bore into the seed capsules to feast upon the enclosed seeds, thus causing the cotton bolls to wither and drop off before the cotton is ripe. It is therefore advisable to let the prospective cotton growers of Australia know what insect pests they have already in this country, and also to call their attention to those that may be accidentally introduced in seed or unginned cotton.

The handsome little moths included in the genus *Earias* have a world-wide distribution. Twenty-one species are listed and described in the eleventh volume of Sir George Hampson's "Catalogue of the *Lepidoptera Phalaenae*" (1912) in the British Museum. Most of them are distributed over Africa, Asia, the Malay Archipelago, and Australia. Some have a very extended range. *Earias chlorina* is found in Britain and extends across Europe to Siberia. *Earias insularia*, one of the best known species on account of the damage it does to cotton, is found widely distributed over Africa. It ranges across Asia, India, and Ceylon, and comes as far south as Celebes, but it is unknown in Australia. Before the Pink Bollworm (*Gelichia gossypiella*) was accidentally introduced into Egypt from India, *Earias insularia* was the most serious cotton pest in Africa, and it is now the pest second in importance. In India *Earias insularia* and a second species, *Earias fabia,* are known, according to Lefroy, as the "spotted bollworm moths," and they are both well-known cotton pests in that country. Other species of the genus are confined to limited areas. Pratt collected three distinct species in New Guinea in 1905. Another is peculiar to Christmas Island. Six species have been recorded from Australia, four of which do not extend beyond this country. The following species are well known cotton pests, or else are species which are found in Australia, and of which some will in all probability turn their attention to cultivated cotton.

The Egyptian Cotton Bollworm (*Erias insularia,* Boisd).

This moth was originally described and figured by the French naturalist, Boisduval, in his "Fauna of Madagascar," in 1833. It has been described since that date under several other specific names. A detailed description will be found in Hampson's "Catalogue," previously quoted. Willcocks describes and figures it in a paper entitled "Insects injurious to the Cotton plant in Egypt," published in the *Year Book* of the Khedival Agricultural Society, Cairo, 1905. It is a handsome little moth, very variable in colouration; it measures a little over three-quarters of an inch across the outspread wings. The typical form has the head, thorax, and fore-wing rich pea-green, with the wings traversed with three irregular transverse bands of a darker colour. The body is silvery, the hind-wings silvery white, with an encircling fuscous band within the outer margins. Another well-defined variety has the head, thorax, and fore-wings dull yellow, the irregular transverse bands crossed with a pale green stripe through the centre of the wing. The moth lays her eggs upon the terminal buds or the cotton bolls. In the first stage of infestation the tiny caterpillars bore down the terminal bud or eat out the centre of the flower; but, as they increase in size, they turn their attention to the immature bolls, boring a hole through the side and feeding upon the soft juicy seeds, their presence thus causing the infested bolls to wither and drop off.

The Indian Bollworm (*Earias fabia,* Stoll).

This moth was described and figured by Stoll under the name of *Noctua fabia* in 1782, from India. It has also been re-described by subsequent writers under several different names. Its synonomy and description will be found in Hampson's "Catalogue" (Vol. XI, No. 6872, p. 507). It has a wide range over India, Ceylon, Burma, Andaman Islands and Java, and is also recorded from Fiji. Lefroy states that this is the most common of the two "spotted bollworms" attacking cotton in India. It measures about two-thirds of an inch across the outspread wings. It is of a general pale yellow or buff tint, and has a parallel stripe of green down the centre of the wings, narrow at the shoulders, and widest at the outer margin of the tip of the wings. But although this is the typical form, the green central stripe may be absent. Lefroy and Howlett in "Indian Insect Life" (1909, p. 456) say that it feeds on the seeds and shoots of cotton and chinda (*Hibiscus Esculentus*), and, together with the green-winged *Earias insularia*, is one of the important cotton pests.

The Australian Green-striped Bollworm (*Earias huegeli*, Rogenh.).

This pretty little moth was originally described in 1870. It is figured and described in Hampson's "Catalogue" (p. 502, pl. clxxxvii, fig. 9). It has a very wide range in Australia, from Broken Hill to Port Darwin. I have bred it from cotton bolls grown at the Hawkesbury Agricultural College, Richmond, and also from the seed bolls of the "wild cotton bush" (*Hibiscus crinum*) growing near Moree, New South Wales As well as from Australasia, it has been recorded from Tahiti, the Gilbert Islands, Africa, the Marquesas Islands, and Fiji. It is a dainty little moth, of a general silvery-white tint The central portion of the fore-wings are striped with rich deep green, but these green markings vary much in intensity; according to Hampson, the green tints are sometimes replaced with rufous. It measures about an inch across the outspread wings. This is our common species. It takes the place of *Earias fabia* in India, and of *E. Insularia* in Egypt, with which it was originally confounded by our economic entomologists.

This moth has, on several occasions, been bred from cotton bolls that have been sent in to the Entomological Laboratory. The caterpillars are elongate, spiny grubs, about half-an-inch in length. They are of a uniform creamy-white or grey tint mottled with yellow, and are furnished with fleshy spines and hairs on the sides of each segment. When full grown they usually crawl out of the boll, and construct a stout silken cocoon of somewhat irregular form. This cocoon may be attached to some part of the cotton plant, or attached to a clod of earth beneath the host plant.

Earias smaragdina, Butler

This moth was originally described by Butler in the *Transactions of the Entomological Society of London*, in 1886. Hampson figures and describes it in his "Catalogue" (p. 509, pl. clxxxvii., fig. 17). It has been collected from several localities in Queensland, and it is recorded from New South Wales. It measures just two-thirds of an inch across the expanded wings. The head and prothorax are greenish-yellow, with the rest of the thorax greenish. The fore-wings are yellowish green with the front margin whitish but tinged with yellow towards the base. The hind wings are white. I have specimens bred from cocoons found in codlin moth bandages upon apple trees in the Gosford district, New South Wales.

Earias parallela, Lucas.

This species was described from Queensland by Lucas in the ***Proceedings of the Royal Society of Queensland*** in 1898. It is figured and described by Hampson (p 504, pl. clxxxvii, fig. 10). It has a wide range over Australia, and has been recorded from various parts of western and north-western Australia, also from Melbourne, Victoria It is a larger species than the last-mentioned, measuring about an inch across the out-spread wings. The head, thorax and abdomen are yellowish-white; the fore-wings are light yellow sometimes tinged with green, crossed transversely with four narrow, slightly waved, green bands. The hind-wings are white, clouded on the outer margin with brown.

Earias subviridis, Lucas.

This was described in the same paper as the previous species. Meyrick described it as a new species in 1902 under the name of ***Earias limonia***, in the *Transactions of the Entomological Society of London.* Hampson figures and describes it (p. 504, pl. clxxxvii, fig. 11). It has been obtained at Brisbane, Queensland, and also on the Richmond River, New South Wales. It is one of the largest species, measuring over an inch across the out-spread wings. The head and thorax are white, the thorax tinged with light green; the abdomen is white. The fore-wings, according to Hampson, are "silky white with a blue-green tinge," but the lithographer makes the fore-wings decidedly green in the illustration, with two irregular curved transverse bars across the centre. The hind pair are dull yellow.

Earias ochrophylla, Turner.

This moth was described by Turner in the ***Proceedings of the Linnean Society of New South Wales*** (Vol. xxvii, p. 108, 1902), from specimens collected at Birchip, Victoria. Hampson gives the other localities as Derby (West Australia), Broken Hill, and another undefined locality in New South Wales. The species is small, about the same size as ***Earias smaragdina.*** The head is whitish, tinged with yellow; the thorax pale yellow, and the abdomen whitish. Hampson says: "Fore-wings very pale greenish-yellow, the costal area white,' but the figure given is all yellow. Turner says: "Fore-wings pale yellow, greenish tinged, sometimes partly suffused with pale grey between veins, sometimes two oblique lines of deeper colour in terminal part of disc." Hind wing whitish.

Earias luteolaria, Hampson.

This moth was originally recorded from southern India and Ceylon. It was described and figured by Hampson in Ill. Heterocera, British Museum (Vol. viii, p. 46, pl. 139, fig. 16, 1891). It has since been recorded from New Caledonia, and from Brisbane, Queensland. It is a bright yellow moth with whitish hind-wings tinged with yellow. It measures an inch across the out-spread wings. There are several varietal forms, according to Hampson—a orange yellow form with brown spots on the lines, and another with the terminal area of the fore-wing suffused with pink.

The Relationship of Bacteria to the Quality of Cheddar Cheese.

J. K. MURRAY, Lecturer in Bacteriology, Hawkesbury Agricultural College.

EXPERIMENTS have demonstrated that there is no direct connection between mere numbers of bacteria in the raw milk and the quality of the ripened cheese. Thus G. J. Hucker[1] says: "no relationship could be definitely established between the total number of bacteria present in the milk at different stages and the quality of the cheese." But there is a very definite and direct relation between the types of bacteria and their respective numbers in the raw milk and the quality of the cheese manufactured from it. Professor F. C. Harrison[2] first demonstrated this connection under conditions approximating to those of New South Wales.

Butter and cheese conditions are not parallel. Butter made from raw cream by no means contains all the progeny of the bacteria, yeasts and moulds present in the parent raw milks, large numbers of the cells having been removed in separator slime, separated milk, butter-milk, wash waters, and expressed brine. On the other hand, cheese made from raw milk probably contains, at the time of putting to press, 80 per cent. or more of the progeny of the original raw milk cells. Some are lost in the whey, but these losses are comparatively small, microbes escaping only from the cut surfaces of the curd, and not from the interior of curd particles, where they became fixed at the time of coagulation. Progeny numbers are probably affected by the different physical and chemical conditions which prevail in whey and curd; thus the curd environment makes for colony formation, while whey favours free cell suspension. During pressing the expelled whey may, under certain conditions, contain large numbers of bacteria as well as a high percentage of butter-fat, but it is unlikely that the bacterial loss has any marked effect on cheese quality. The essential feature is that, once the curd has been formed, the cheese-maker can do little favourably to alter the types of bacteria and their relative proportions; most success lies in the use of low temperatures during curing.

The bacterial flora of the raw milk is the biggest factor in the quality, meaning thereby flavour and aroma particularly, of the raw milk cheddar cheese. The characteristic aroma of choicest cheddar cheese is almost exclusively a feature resulting from the interplay of bacterial activities. This aroma does not form if the cheese be chloroformed, thus paralysing bacterial activity. The production of the major portion of the flavour is also a function of bacteria, while the activity of some of the species profoundly affects the texture and body of the cheese by encouraging rennet action and producing substances which modify the physical and chemical properties of the curd. It is equally true that bacteria are in the same degree responsible for low-quality, unsaleable cheddar cheese. If desirable types of bacteria predominate, controlling the fermentations in the milk, curd, and ripening cheese, then the aroma and flavour will be characteristic and good; with undesirable microbial types predominating and controlling, the flavour and aroma will be bad. It follows that to produce uniformly high quality cheese we must—

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[1] This and succeeding figure references relate to literature cited on page 876.

(*a*) improve the bacterial quality of the raw milk by better methods of production and handling;

(*b*) accepting present average milks, pasteurise them and, having thus killed the great majority of both favourable and unfavourable types, inoculate with the essential favourable bacteria by the use of a good starter; or,

(*c*) combine (*a*) with the pasteurisation process.

Desirable Types of Bacteria.

There are probably three, possibly four, bacterial groups of marked importance in the production of matured cheddar cheese. Of these groups the basic organism is a vigorous acid-producing culture of *Streptococcus lactis* (Lister).* Such a culture is highly efficient, converting about 90 per cent. of the lactose (milk-sugar) it uses into lactic acid. Much of the chemical and physical alteration which the milk solids undergo during cheese-making and ripening is the result of their interaction with this acid. Moreover, putrefaction is guarded against by the presence of lactic acid and lactates in normal amount. Lactic acid is not a volatile acid, and therefore contributes little directly to the aroma. Professor B. W. Hammer[3], [4], of the Iowa Agricultural College, in collaboration with other workers, has shown that there are bacteria associated with the common milk-souring type, and that these associated bacteria produce little lactic acid but marked volatile acidity. They have also shown that the volatile acidity produced by a pure culture of *Streptococcus lactis* (Lister) is much lower than that produced by good starters. Professor Hammer[4] says: "There are at least two types of organisms associated with *S. lacticus* in starters frequently enough to be considered important . . . . In general both creamery and commercial cultures contained much larger numbers of *S. lacticus* than of the associated organisms. *S. lacticus* often made up 90 per cent. of the flora, and only occasionally fell under 75 per cent. In some cases the associated types made up only 1 to 3 per cent. of the flora. Satisfactory starters can be prepared from mixtures of *Streptococcus lacticus*, and one or both of the associated types, but not from pure cultures of *S. lacticus*." Orla-Jensen[5] says, in speaking of starters: "All these cultures which are propagated in the best pasteurised milk, generally contain several different species of lactic acid bacteria, and very probably they owe their good qualities to this very fact, for a higher degree of acidity is obtained from the co-operation of several species than by the action of one species alone, while lactic acid bacteria in pure culture are apt to degenerate and become slimy." These points of view only approximately coincide, but the quotations may indicate that certain associated and favourable bacteria assist the *Streptococcus lactis* in the production of normal changes in cheddar cheese. It would appear that Hammer's associated organisms play a considerable part in the production of aroma and flavour. An examination, by the writer, of a starter in use at the Bodalla Estate's cheese factories showed acid production to be vigorous, the flavour and aroma to be good, and the presence of 7 per cent. of bacteria which, while showing growth in litmus milk, did not produce noticeable acidity or coagulation. Facilities did not admit of further investigation.

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* The Society of American Bacteriologists has recommended the use of *Streptococcus lactis* (Lister) in place of *Streptococcus lacticus* (Kruse) and *Bacterium lactis acidi* (Leichmann). (Abstracts of Bacteriology, Vol. VI, Abs. 1).

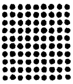
The remaining one or two groups of bacteria which are considered to play a part in the ripening of cheddar cheese are probably derived from the natural flora of the milk and may not markedly increase their numbers until a comparatively late stage in the ripening. The successful use of pasteurisation in the manufacture of so much of New Zealand's export cheddar cheese, casts some doubt on the essential nature of any bacterial group not found in an average factory starter or pasteurised milk. It is, of course, possible that certain heat-resisting strains of the long lactic bacteria (*lactobacilli*) may survive regenerative pasteurisation at 165 deg. Fah., and thus be found in the bulk milk. Their presence in average starter is less likely on account of the higher temperatures and longer period of heating in general use.

Harmful Types of Bacteria.

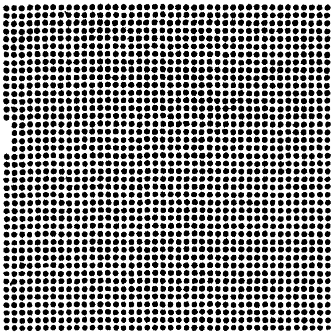
The cheese-maker's greatest fermentation trouble is brought about by the group of bacteria known as the harmful gas-producers (the *B. coli-aerogenes* or *B. acidi lactici* group). The mere production of gas is not, in itself. necessarily harmful, being characteristic in Emmental or Swiss cheese. The cheddar process, however, does not favour gas-producers of the Emmental type (propionic acid bacteria) whose by-products are of pleasant flavour and aroma. When gas is formed by bacteria in the curd or ripening cheddar cheese, the group concerned is the harmful, or *B. coli-aerogenes* one. This, group consists of many members, but those of importance in the cheese-making process are *B. lactis aerogenes*, *B. coli communis* and *B. acidi lactici*. They produce two gases, hydrogen and carbon dioxide. These gases are not of unpleasant smell. The unfavourable aroma and flavour associated with gassy curd and cheese is due to the formation of volatile esters of unpleasant aroma. In fermenting the milk-sugar this group of bacteria produce only one-third of the amount of lactic acid (and even this is the laevo modification) which *Streptococcus lactis* forms from the same quantity of milk-sugar. It is replaced by considerable quantities of acetic acid. The bacteria in this group not only adversely affect aroma and flavour, but also

GRAPHICAL REPRESENTATION OF NUMBER OF BACTERIA DEVELOPING IN MILK AT DIFFERENT TEMPERATURES IN 12 HOURS FROM ONE INDIVIDUAL BACTERIUM.

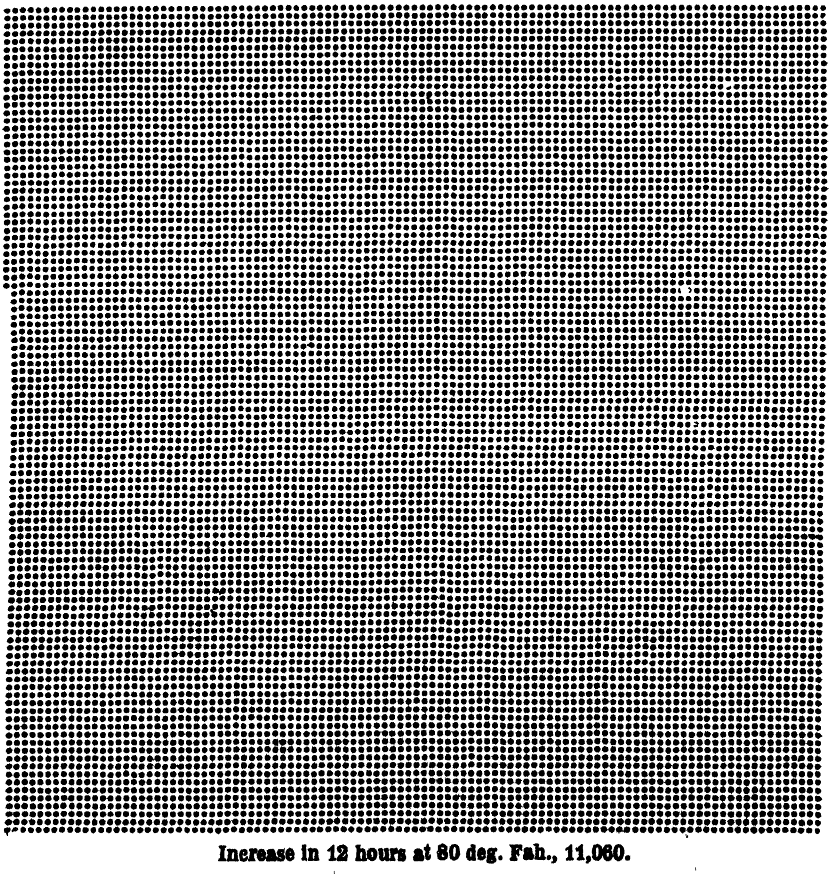
Increase in 12 hours at 50 deg. Fah., 8.



Increase in 12 hours at 60 deg. Fah., 90.



Increase in 12 hours at 70 deg. Fah., 1,760.



Increase in 12 hours at 80 deg. Fah., 11,060.

detract from body and texture, and afford little protection for the ripening cheese against bacteria more markedly putrefactive than themselves. It follows that cheeses in which there has been marked gas formation by this group are apt to putrefy—become "stinkers."

The main sources of these bacteria in milk are from contamination by manure and by carelessly cleaned utensils. They are favoured by temperatures which approach that of the cow's body—such as those of poorly-cooled milk, renneting, cooking and cheddaring.

Control of Bacterial Activity by the Farmer.

The farmer is able to control bacterial activity in milk by restricting the numbers of the different types of bacteria gaining entry, and by the use of measures to reduce multiplication and fermentation of those which do. He must check all types of fermentation. The cheese-maker is assisted by the activity of the "true lactic" fermenting bacteria (*Streptococcus lactis* group), but only when the great majority of this activity occurs under his control. A marked fermentation of this class prior to the arrival of the milk at the receiving platform renders the milk "fast," with consequent loss in quality and yield.

Checking Bacterial Activity.

Cooling the milk is the easiest, cheapest, and most desirable and efficient method open to the farmer for the purpose of restricting the activity of all the bacteria which have gained entry to his milk. Moreover, within the limits of cooling usual on a farm, this practice alters the relationship of the bacterial groups so that the desirable *Streptococcus lactis* type obtains predominance. Milk for cheese-making should be cooled immediately after it is drawn, and be kept as cool as economically possible until its arrival at the factory.

The way in which cooling milk and keeping it cool checks the development of bacteria is strikingly shown in the following table, and its graphical representation on page 870. These are drawn up on the basis of data given by W. A. Stocking[6]. Portions of milk containing 5,000 bacteria per cubic centimeter were held for twelve hours at 80 degrees, 70 degrees, 60 degrees, and 50 degrees Fah. respectively. The number of bacteria present, and the number which would result from the growth of one under these conditions, are shown.

Number of Bacteria in the Fresh Milk per c.c.	Temperature at which Milk was held.	Number of Bacteria per c.c. at end of twelve hours.	Number of Bacteria which would result from one at end of twelve hours.
5,000	80 degrees Fah.	55,300,000	11,060
5,000	70 ,,	8,800,000	1,760
5,000	60 ,,	453,000	90
5,000	50 ,,	38,000	8

It is obvious that the multiplication increase outweighs increases due to ordinary contamination, though the latter is serious enough. The necessity of equipping the dairy farm should not, but does, need stressing. The farm objective should be to cool the milk rapidly to 60 deg. Fah. or lower, and keep it there. One is aware of the difficulties presented by Australian summer conditions, but a good water supply is an essential under modern dairying conditions, coolers are a paying investment, and the difficulties urged in connection with them have been overstressed. Our summer conditions make the maximum use of what cooling facilities farm locations provide as essential a part of the day's routine as the cleaning of utensils.

Even at the risk of repetition it seems desirable to draw attention to the fact that cooling milk and keeping it cool not only lessens all bacterial activity, but causes the harmful gas-producing *(B. coli-aerogenes)* group to fall off in numbers compared with the desirable true lactic fermenting *(Streptococcus lactis)* type. These gas-forming bacteria are very difficult to control in summer, because, during this season, the temperature of the milk (unless cooled and kept cool) most nearly approaches that at which they make their greatest relative and absolute increase. This double checking of the harmful gas-producing group as a result of lowering the temperature of milk is not appreciated in the way it deserves.

Reducing Contamination from Farm Sources.

Experiments at this College lend support to the conclusions drawn from much excellent work carried out in the United States [7,8,9]. Attention should be particularly devoted to:—

1. Removal of mud and manure from the cow's udder, teats, flanks and tail, and the cleaning of the udder and teats with a damp cloth immediately prior to milking.
2. Thorough cleaning, scalding and drying (by rapid evaporation) of all utensils.

Manurial Contamination.

The writer believes that too little attention has been given to the reduction of manurial and mud contamination. The types of bacteria in cow manure, and consequently mud, include those causing the gravest trouble in cheese factories. The marked demand for low bacterial counts in market milk has focussed attention on numbers of bacteria rather than types, and, as previously indicated, there is no distinct relationship under factory conditions between total counts of ordinarily accepted milks and cheese quality[1].

The gross number of bacteria finding their way into milk from manurial contamination is less than that probable from some other sources. Orla-Jensen[5] states that "cow dung contains over 1,000 million organisms per gram." S. H. Ayers, L. B. Cook, and P. W. Clemmer[7], using plain extract agar, and incubating for five days at 30 deg. Cent., obtained an average figure under Maryland (U.S.A) conditions, of slightly under 50 millions per gram. Counts made at this College have frequently run into thousands of millions per gram. The following nine high counts of fresh manure indicate that contamination by intestinal bacteria may be considerable.

Bacterial Content of Manure.*

Millions of Bacteria per gram.	Approximate millions of Bacteria per ounce.	Medium used.
27,610	800,000	Whey agar
11,276	327,000	pH = 6.6.
7,789	225,000	,,
7,200	208,000	,,
2,513	72,000	,,
10,800	313,000	Lactose litmus
9,413	272,000	agar, pH = 6.8.
5,210	151,000	Plain nutrient
3,470	100,000	agar, pH = 6.8.
9,476	274,000	Average.

* Incubated at room temperature for seven days. Jersey cattle, fed maize silage, lucerne hay, green cereals, bran, and copra cake.

Taking the lowest of these figures, the average bucket of milk, containing somewhat over two gallons, would receive an addition of 2,000 intestinal bacteria per c.c. from one one-hundredth of a gram of manure.

To produce a good quality milk for cheese-making, contamination of a manurial nature must be reduced—more because of the type of bacteria added from such a source than on account of the number, though this may be considerable. Reduction of manurial contamination may be accomplished by adopting some or all of the following precautions:—

(a) The exercise of more care in feeding, thus checking diarrhoea, which not only increases the number of bacteria per unit weight of manure, but causes increased smearing and splashing of manure on the tail, flanks, udder, and teats; moreover, on the authority of Richmond[10], diarrhoea decreases the butter-fat content of milk.

(b) Cleaning the tail, flanks, udder and teats, since friction during milking detaches particles of dung, &c., which may fall into the bucket.

(c) Washing the udder and teats with a rinsed damp cloth prior to milking.

(n) Rinsing the hands after adjusting leg ropes, cow's tail, &c.; or, better, dispensing with leg ropes.

(e) The use of smaller topped pails than those at present in vogue. The design must be reasonably easy to milk into and easily cleaned.

Contamination by Utensils.

There is quite a mass of experimental evidence [7], [8], [9], [11], &c., to demonstrate that contamination from improperly cared for utensils is a prolific source of milk contamination. With the common practice of taking whey to the farm in milk cans, milk for cheese is particularly liable to utensil contamination. The whey is frequently in an advanced stage of fermentation and the number of bacteria per unit volume is high. Were the whey genuinely pasteurised this source of contamination would not be so grave. To merely heat the whey to blood-heat or a little over is but to exaggerate the evil by encouraging gas-forming groups.

The following extracts are definite evidence of the serious nature of contamination by utensils:—

"An examination of 170 freshly washed cans showed the presence of very large numbers of bacteria. Had these freshly-washed cans been filled with sterile milk, the germ content of the milk would have . . . . averaged 128,592 bacteria per cubic centimeter. It seems to the authors that. . . too much stress has been laid on practices of minor importance and the influence of utensils poorly steamed and not dried has been commonly neglected."[8]

"The work of Prucha, Harding, and Weeter and our own experiments indicate clearly that the use of sterilised utensils is the greatest factor in the production of milk of low bacterial count . . . The washings from the unsterilised cans contained high percentages of the alkali forming bacteria and particularly the peptonising group. The addition of peptonising bacteria in large numbers is a matter of considerable importance since they may be highly undesirable in that they produce undesirable changes."[7]

Some determinations of the contamination of milk by buckets have been made. The washing of the pails was done by the writer and by students, and was better than that usual on the average farm. Even so, the influence of steaming on the bacterial content is striking. In the table given below the figures represent only part of the total organisms present, being obtained by rinsing with 500 c.c. of sterile saline solution for one minute. Whey agar petri dish cultures were then made in quadruplicate and incubated seven days at room temperature.

The pails were scrubbed in cold water, washed in hot soda water (temperature varying on different days from 126 to 149 deg. Fah.), and then divided into two groups. One group was rinsed in hot water (145 to 155 deg. Fah.), inverted on drying shelves and left for four hours. The other group of pails were steamed for sixty seconds and inverted on the same set of shelves to dry.

Bacterial Content of Milking Buckets.

	Buckets scrubbed in cold water, washed in hot soda water, rinsed in hot water, and inverted to dry.	Buckets scrubbed in cold water, washed in hot soda water, steamed for sixty seconds, and inverted to dry.
	49,000	6,300
	31,000	3,200
	926,000	52,900
	29,000	4,400
	741,000	39,700
	57,000	7,400
	64,000	6,600
	193,000	14,600
	59,000	3,500
	276,000	28,200
	11,000	1,800
	3,000	1,500
	2,417,000	33,400
	513,000	29,300
	827,000	51,000
	134,000	10,400
	256,000	25,100
Average,	387,000	18,800

It is evident that the bacteria added to the milk by utensils can be reduced by more than 90 per cent. if steps be taken to partly sterilise them. The use of steam on the farm is only exceptionally possible at present. It is likely that immersion of well-cleaned utensils into vigorously boiling water, and allowing them to reach its temperature, is very effective both germicidally and by virtue of subsequent rapid drying. Completed figures are not yet available. Practicable farm methods of greatly reducing the contamination due to utensils would appear to be :—

1. Thorough scrubbing in cold or luke-warm water. Hot water at this stage makes cleaning very difficult.
2. Scrubbing in a hot soda solution.
3. Immersing in actively boiling water for ten or more seconds.
4. Inverting to dry in a sunny, dust-free atmosphere.

Rapid drying is very important because, without moisture, bacteria cannot increase their numbers. Immersion in boiling water or steaming means rapid drying, because hot water runs off vessels almost twice as readily as cold, and the heated metal rapidly evaporates the water film. Most utensils sold by reputable suppliers are now made free from corners and crevices difficult to clean and forming infective foci. Battered or rusty utensils are a constant source of milk infection, because they are impossible to clean. A piece of such a can under the microscope has a surface consisting of ridges and valleys, craters and peaks ; and in the recesses microbes and milk are safe from brush, and well guarded against heat.

Where whey is conveyed in the milk cans, particular care should be taken with their cleaning. Such cans are apt to be greasy, are certainly heavily infected with bacteria, and, if not thoroughly cleaned and scalded, will heavily contaminate the milk. Whenever there is doubt of a can having been properly attended to, it should be well scalded and cooled before milk is placed in it.

Control of Bacterial Activity by the Factory.

The factory management cannot greatly alter the bacterial quality of the accepted milk. The addition of starter to raw milk during the winter months hastens the ripening of the milk, and adds a good strain of the desirable true lactic fermenting bacteria; but when the full supply is coming in, the bacterial content is so high and the rise of acidity so fast, that further addition of acid-forming bacteria adds to the difficulty of "fast" batches. For average New South Wales and Queensland conditions the quality of cheese will be most easily improved by pasteurising the milk and inoculating it with a first quality starter.

The factory can improve the quality of the milk supplied to it by advocating clean milking, and detecting dirty producers by the occasional use of a rapid sediment tester ; by encouraging the installation of farm coolers; by insisting on the conveyance of milk in cans reasonably free from injury and of sanitary pattern ; and by a genuine pasteurising of the whey, thus helping in the prevention of tuberculosis in suppliers' calves as well as considerably reducing the amount of milk contamination by utensil bacteria.

The use of low temperatures during curing is one of the surest methods of limiting the activity of gas-forming bacteria in raw milk cheese. The Quebec Cheesemakers' Co-operative Society (La Société Agricole Co-opérative des Fromagers de Québec) employs large central curing rooms, as does also the Quebec firm of Lovell and Christmas, in each case the temperature being kept within the range of 40 to 60 deg. Fah. With cheese made from pasteurised milk the call for low temperature conditions to regulate the type of bacterial action may be replaced by the desire to curtail moisture losses.

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TWISTING IN GRAVENSTEIN APPLE TREES.

"We are troubled with very bad 'twisting' on our Gravensteins (aged about 10 years), many of which have already strangled main leaders clean off," wrote an orchardist recently. "The operation of slitting the bark up the edges of the depressions and flats does not appear to have been severe enough, or in some cases effective at all. The trees are vigorous in growth and crop well. I would appreciate any advice."

Twisting is very common in Gravenstein apple trees when they have been worked on Northern Spy stock, and the tendency seems to defy treatment. Gravensteins worked on seedling stocks, however, sometimes fail to show this inclination though quite old, and where trees have been worked from these on roots from non-twisting trees they also are free from twist. Some growers claim positively that Gravenstein will not twist on any seedling stock. The variety should certainly be worked on seedling stock, raised from pips of, say, Gravenstein, London Pippin, Reinette de Canada or some other fairly aphis-resistant sort rather than on Northern Spy.—W. le Gay Brereton, Assistant Fruit Expert.

Pig-raising in New South Wales.

[Continued from page 801.]

A. F. GRAY, Piggery Instructor, Hawkesbury Agricultural College.

Piggery Buildings.

THE buildings should be constructed so as to admit plenty of sunlight, There is no disinfectant so cheap or so effective as sunlight, and whatever the fall of the land, the piggery must be arranged so as to get the maximum amount of it. It is also essential that the buildings be closed on the side from which bad weather mostly comes, and should face the good weather quarter, which in most parts of this State is the north-east.

Badly-drained and ill-ventilated sties mean stunted, slow-maturing, unprofitable pigs.

The size and number of sties, yards, and paddocks will have to be determined by requirements and conditions, but the more exercise the pigs have, and the more they are kept in the open, the better will be the results. The yards should be protected from prevailing winds by trees grown in and around the site. It is most essential to protect the yards from exposure to cold, as this checks the growth of young pigs.

Pigs develop rheumatism and chest affections readily by being forced to live on a damp or cold floor; but as brick or concrete floors in the sties are certainly the most durable, they are recommended. Each floor should be provided with a wooden platform on which the pigs can sleep. The platform requires to be grooved for drainage and cleaning purposes, and may be made of 3 x 1 inch hardwood mounted on heavier crosspieces. This platform should be so constructed that it can be easily lifted for the floor underneath to be cleaned. In the case of boar pens and farrowing pens it is necessary to construct a more permanent platform of heavier material, say 3 by 2 inch hardwood, set in pitch and tarred over.

During the cold winter months ample dry bedding must be placed on the platform in order to afford the pigs every comfort. Such care certainly gives results by keeping the animals in better condition.

A good water supply is required both for the stock and for purposes of cleansing the premises.

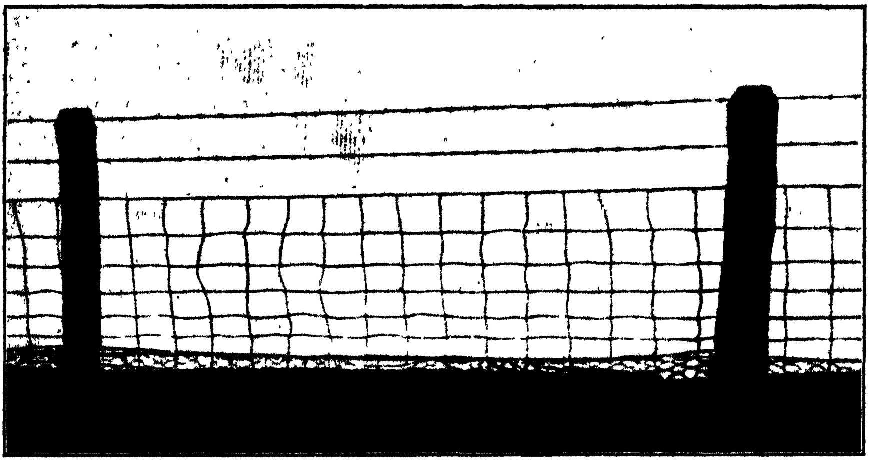
A " hospital sty " is essential for any outbreak of contagious disease, &c., or for observation, but it should be some distance from any other pig yards or pens in order to ensure that the disease shall not spread to healthy pigs. This sty is often useful for housing pigs that are being brought into the piggery for the first time, as it will enable the farmer to quarantine all new stock until it is apparent that it is quite safe to allow them to come in contact with the other pigs. This period of quarantine should last for thirty days, and the quarantined animals should be under observation the whole time.

Wood fences are generally recognised to be the best, but for various reasons these cannot always be erected, and other kinds of fencing have to be substituted. Of these, woven wire, obtainable in various designs, proves very effective. Wire netting can also be used, but does not last long against the strain of large pigs; barbed wire can also be used, but is rather dangerous.

Where possible only open drains should be used in the draining of the sheds, yards, &c. Covered drains give a lot of trouble, and can never be kept in the same sanitary condition as the open ones which the sunlight acts upon.

Selecting the Boar and the Sow.

The brood sow and boar are the foundations of the pig farm, and they must receive such food and care as will ensure strong healthy litters. Prolificacy, though more or less an inherited character, is to a large extent controlled by the feed and care of the parent animals.

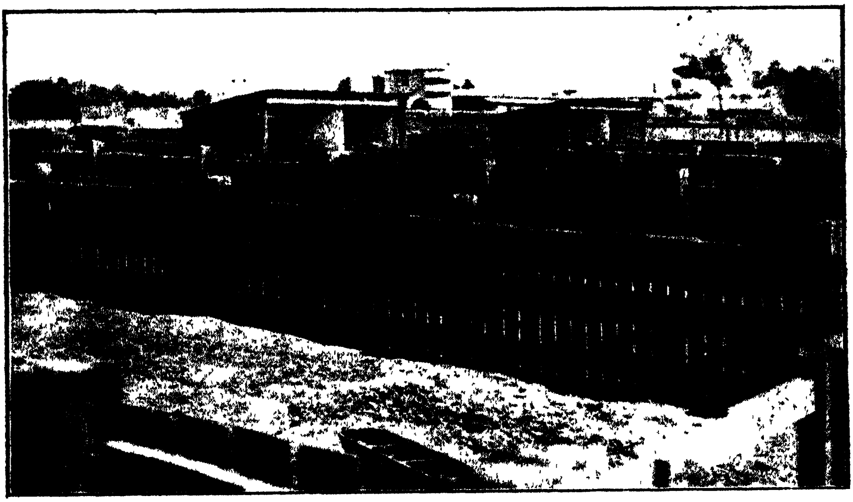


A Woven Wire Fence, suitable for Pigs.

The Boar.

When selecting the herd boar the best available should be obtained, for during his life he may be the sire of hundreds of pigs, while the sow can only produce a limited number. If the boar is good he will improve the standard of the herd, but if he is a mongrel or crossbred he will limit the profits of the pig farmer. His selection, therefore, is of very great importance. The boar should come from a large, thrifty litter, and be purchased from a reliable breeder. He should be a little more on the compact side than the sow, not too chunky or short, but showing full development at every point, and of a strictly masculine type representing the full type of his breed. He must show quality, smoothness and evenness in every part, a typical masculine head, eyes and ears wide apart, the jowl reasonably full and well laid out on to the shoulders, which should be smooth and free from wrinkles; there should be a full heart-girth extending well down to the bottom lines, nearly or quite on a level, with as deep a flank as possible; rather short or medium length legs, with bone of fair size and quality, pasterns short and straight, and the hoops well set, legs standing square, straight and well under him; a long, wide and deep ham, and tail well set up.

The disposition and good behaviour of the boar depends much on how he is handled from a sucker until he is matured. Docility is a great point, and the boar should always be handled quietly and kindly. He should be kept in a securely-fenced yard or small paddock, with grass to graze on, if at all possible, and be provided with a dry shed to sleep in, ample bedding in the winter, and plenty of shade and water for the hot weather.



Fences suitable for Boars.

The open sheds are each divided to serve two yards.

The boar requires to be well fed, but not kept too fat, and he should be provided with ample exercise to keep him fit. He should be kept by himself and a record kept of when he is mated with each sow. It is advisable not to use the boar for service until he is at least 10 months old, and for his first year seven or eight sows will be sufficient for him to attend; after that he will be able to manage from thirty to forty sows each year.

His feed should be varied and made up from any of the following :—Peas, barley, wheat, maize, skim milk, and kitchen swill as a morning feed. Plenty of lucerne, rape, green barley, or mangolds should be given in the afternoon. Clean drinking water, wood ashes, charcoal, and a small piece of rock salt should always be provided in his pen. With proper care and attention, he will be serviceable for about seven years.

The Sow.

In laying the foundation of a herd of brood sows it is necessary to consider what breed is going to suit best from a feeding and market point of view. When this has been decided upon it is well to stick to the choice, and obtain all the information possible. In making the selection of brood sows, whether pure-bred or grade, select only those that show good length of body, well-sprung ribs, and deep sides. A full loin, long, deep, and well-rounded hams, straight legs not too high off the ground, and a good girth, allowing room for full heart and lung action, are all essential.

The head should be characteristic of the breed, the neck short with a full jowl, but not heavy or hanging; shoulders well filled, but not so broad on top as to give a flat appearance. She should have a strong back, slightly arched so as to avoid sagging when she is carrying a litter. She should not droop too much from the loin coupling to the tail—that is, her tail should be set high, so as to give her back a good appearance. She should be light in the bone, and well set on her pasterns and feet; the hoofs rather short, so as to provide against sprawling. She should have plenty of hair, not curly or coarse, but smooth; swirls in the hair should be avoided.

Paling Fence, suitable for Sows or Young Pigs.

Note the open cement drain.

In selecting a sow of any breed her markings should be as even as possible, though this is not so essential as quality, size, and conformation. She should have a soft, mellow skin, which shows feeding quality; should be selected from a large thrifty litter, and have at least twelve well-formed teats.

Select always from a reliable breeder, and begin first with the number of sows for which there is food; when food and experience increases add more sows, not before.

It is advisable not to mate the sow until she is at least 10 months old, and she should not be judged as a breeder on her first litter. If she is not old enough when put to the boar the result will be inferior and weak-constitutioned suckers and a poor mother. She can be retained as long as she is a satisfactory producer, usually until 6 to 7 years old. Best results are obtained if she is not too fat when mated. When not in pig or suckling she will be in heat every twenty-one days. The best time to mate is May and November, so as to avoid the extremes of heat and cold for the suckers. Brood sows should always have a paddock for themselves in which to graze, and should not be run with any other animals on the farm.

Care and Management of the Sow.

After the sow has been stinted, the date of which should be recorded, she is turned into the grazing paddock, where she can be kept at very little cost for at least twelve weeks out of the sixteen of the gestation period. Her feed should consist of grass (preferably couch) or lucerne, pumpkins, rape, and barley, and care should be taken that she has an ample supply of good clean water. Only in the cold weather does she need any extra feed, such as grains, milk, &c. She requires a dry shed to live in, and plenty of clean bedding in the cold weather. Ample exercise at all times is very essential. It is advisable not to run too many sows in one paddock, in order to avoid overcrowding, which may cause trouble with the sows heavy in pig. Wood ashes or cinders and a piece of rock salt should always be in their run

The time to bring her in from the grazing paddock to the farrowing pen depends on her condition. If she is fat she may remain to within two weeks of her farrowing, but if on the lean side it is advisable to pen her at least one month before farrowing, in order to feed her better and get her ready. After she has been put into her pen (about 8 feet square, provided with a farrowing rail at the back of the pen and on two sides, and with an exercise yard measuring 40 by 8 feet) she should be attended to regularly, care being taken that she has ample exercise and that her bowels are kept in good order. Her feed now should be of the best, such as skim milk, pollard, and a little bran, with green feed such as lucerne, rape, barley, &c., to produce milk. By her udders one will be able to tell, to a certain extent, what amount of milk she is making, and if she is found to be making excessive milk she should be eased off her feed accordingly, so as to guard against milk fever. Two or three days before she is expected to farrow she requires a dose of castor oil (3 oz. or one wineglassful) given in warm milk or a bran mash first thing in the morning. This, with ample exercise, will keep her bowels right. About twenty-four hours before farrowing she should show signs of milk in her teats, and two hours before farrowing should start to make her bed of *short* dry straw, with which the pen should be well provided. On her first litter someone should be in attendance. She requires quietness, and should not be excited in any way. No assistance is necessary while she is farrowing, unless it is found that she is having trouble in passing a sucker. She can then be assisted by first washing one's hand clean in warm water containing a little disinfectant, soaping the hand well, and trying to remove gently the sucker that may be caught in the passage. If she is wild and restless the suckers can be taken and put in a small box and kept warm with a piece of old blanket.

After the farrowing place the suckers with her, clean away all the wet bedding and after-birth, give fresh straw, and make her comfortable. Feed must not be given for twenty-four hours; then she should be given a warm swill of milk and bran, containing 3 oz. castor oil. She should not be fed as before farrowing for a few days, until she is normal again. She should then be fed on the best, remembering that she has now to sustain herself and her litter as well until the suckers are 1 month old, when they will start to feed from a small low trough provided, and thus ease the sow. All meat diet should be kept from her, for fear she takes a liking for flesh and starts eating her pigs, in which case it is best to fatten her off and send her to market. Care should always be taken to see she and the litter have plenty of food, water, bedding, and exercise, and are in the sunlight as much as possible. The suckers should remain with the sow until they are eight weeks old, when they should be weaned; after which, say about four or five days, she can be mated (if in good enough condition) with the boar again and returned to the grazing paddock. She should then be treated as before, with the object of producing two litters each year.

(*To be continued.*)

PASTURE TRIALS AT GLEN INNES.

IN trials carried out last season at Glen Innes Experiment Farm for the determination of the comparative values of different pastures, a mixture of *Phalaris bulbosa* and White clover again proved the best, carrying 2¼ sheep per acre. Sheep fed on this pasture made a greater gain in weight than those fed on a plot of Cocksfoot, Perennial rye, and Red clover, and a very much greater gain than those run on stubble land and native pasture.—J. N. WHITTET, Agrostologist.

ARGENTINA'S SHEEP POPULATION.

TWENTY-FIVE years ago there were 74,000,000 head of sheep in Argentina, but this number decreased to 67,000,000 in 1908, and still further, to 43,000,000 in 1914. In the last three years the Argentine flocks have decreased about 40 per cent. as the result of drought, disease, and slaughter, so that to-day it is estimated that the numbers are not more than 30,000,000. —*The Meat Trades' Journal*, London.

Staggers or Shivers in Live Stock.

[Concluded from page 806.]

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Experiment No. 9.—*To ascertain whether Staggers can be occasioned by the ingestion of* Lamium amplexicaule.

DURING the investigations into the cause of staggers, it was noted that a plant, identified by the Government Botanist (Mr. J. H. Maiden) as *Lamium amplexicaule* (*Labiatæ*), was held by observant stockowners to be a cause of the disease in question. Having been successful in producing staggers experimentally, by feeding sheep with mallow, it was decided to carry out a new series of experiments with *Lamium amplexicaule*. (This plant has no local popular name.) Accordingly eight ewes with lambs, selected from a staggers-free locality, were sent by rail to the district where staggers were held to be due to the plant now under consideration. They arrived on 28th September, 1920, and were taken over bare roads to the place selected for the experiment, where they were placed in two pens, each about 10 feet square, four ewes with lambs being placed in each. These pens were adjoining each other, and all vegetation had previously been removed from them. The ewes were in poor condition on arrival. In one pen the sheep were fed entirely on *Lamium amplexicaule*, cut from a neighbouring paddock, which has always had a bad reputation for staggers. The sheep in the other pen were fed on trefoil, grass, and other herbage from which *L. amplexicaule*, *Stachys arvensis*, and mallow had been carefully excluded. These latter plants were also removed from around the outside of the pen. The sheep fed on *L. amplexicaule* consumed, during the first thirteen days, 281 lb. Afterwards they were placed on a mixed diet of about 40 lb. daily without *L. amplexicaule*. The plant was readily eaten, some animals consuming more than others each day, as is the way when several are together.

On the sixth day (4th October) the sheep were tested by driving. Before moving the animals, the stockman pointed out a particular ewe, which he stated was a most greedy feeder of the plant. The ewes and lambs of both pens were driven together. After travelling along the road for about half a mile, one lamb began to lag behind, and presently exhibited all the clinical symptoms of staggers—the flanks, shoulders, and hind limbs being attacked, and finally the whole body. The symptoms developed to such an extent that the lamb had to be carried until about half a mile from the end of the drive, when it was again permitted to walk. It was able to complete the journey. This lamb was identified as belonging to the ewe observed to be a greedy feeder of the *L. amplexicaule.* About a mile from the commencement of the drive, this particular ewe herself began to show an abnormal gait, the action was stilted, the head carried high, and the animal lagged behind the rest of the sheep. Tremors presently appeared in the thighs and shoulders, and the number of affected muscles increased until the whole of the body was affected. On movement there appeared to be some loss of control of the extremities. The animal then stopped, but was urged on. It then lay down and refused to move, being quite indifferent to a threatened blow. The hind legs became quite flaccid, and shivering ceased. The temperature was 105 5 deg. Fah., the pulse and respiration rapid. There was little or no response to pin-pricks on the legs.

After lying for about five minutes, the animal arose and ran after the flock, but, 30 yards further on, while galloping, the stilted action suddenly reappeared and after continuing a few yards it collapsed with the hind legs stretched out behind. No urging or pushing could induce the animal to move, and it was left. A few minutes later it arose and walked back nearly to the pens, but it again collapsed and was permitted to remain there.

At about 1½ miles, another *Lamium* fed ewe, after galloping a short distance, suddenly collapsed, but it cannot definitely be said that this animal was affected with staggers, although no reason was apparent for its collapse. The three remaining lambs from the *Lamium* fed pens all evinced signs of distress, by lagging behind and "tonguing," whereas no such signs were exhibited by any of the ewes or lambs from the control pen.

There was no difference in the condition of the lambs of the two pens. Water was supplied in an iron trough, and came from a well. The drive lasted about forty-five minutes, and all the animals were rather tired and panting at the termination.

On the twelfth day (10th October), a control ewe died. Post mortem revealed a pneumonia due to heavy lung-worm infestation.

On the thirteenth day (11th October), three lambs fed on *Lamium amplexicaule* were showing symptoms of staggers in the pen.

On the fifteenth day (13th October), the ewes and lambs from both the *Lamium* fed and control pens were examined and tested by driving. They galloped toward the gate of the paddock, about 30 yards distant. At 5 yards from the gates, one of the *Lamium* fed lambs stopped, the whole of the body trembling, and then dropped to the ground. On examination the whole of the muscles were found to be flaccid. Stimuli to the skin and cornea produced no response.. Respirations were spasmodic, with long intervals between expiration and inspiration. When placed on its legs, the lamb collapsed, and died five minutes later on being placed in a car kept for such an emergency. About 50 yards further on, a second *Lamium* fed lamb became affected, the trembling being very pronounced. The animal stopped and then dropped to the ground. The muscles were flaccid, and there was no response to stimulus of the eyeball. Respiration seemed to be suspended for a short period, and then returned spasmodically. After about five minutes the animal rose again and proceeded, but dropped again soon after and was placed in the car. About 200 yards from the commencement of the drive a *Lamium* fed ewe developed pronounced symptoms of staggers and dropped. It also had to be placed in the car. The fourth *Lamium* fed lamb now began to lag behind the rest and showed signs of exhaustion, walking with an arched back. It had to be pushed along, but no symptoms of shivering appeared, nor did it collapse. A second and third of the *Lamium* fed ewes also at this stage began to tongue, and showed a stilty gait with some incoördination of the hind limbs. There was, however, no shivering and no collapse.

None of the control sheep were affected, although toward the end of the drive, which lasted about an hour, all the animals commenced to show a little sign of weariness, and two of the control lambs were tonguing. The pace was steady, and the total distance driven about 2 miles.

A post mortem examination of the lamb that died showed it to be a ewe lamb about six weeks old, and in good condition. All the organs, muscles, &c., were normal, and no gross lesions were detected anywhere. The cranial cavity was not exposed.

On the 18th day of feeding (16th October), the experiments with *Lamium amplexicaule* were discontinued, and both lots of sheep were fed on trefoil, other herbage, and grass free from the suspected plants.

On 4th November (nineteen days after the cessation of the feeding with *Lamium*), all the animals, experimental and control, were driven for approximately the same distance as on 13th October, and at the same pace. Toward the end of the drive the animals previously noted to be affected began to show the usual symptoms, but the control ewes and lambs remained normal. The experiment was then discontinued.

Remarks.—This experiment shows that at least one other plant than mallow, namely, *Lamium amplexicaule*, is a cause of staggers. Of the four ewes and four lambs fed with this plant, three lambs became definitely affected with the condition and the other was probably slightly affected. One ewe showed pronounced, and three indefinite, symptoms of the same complaint. Symptoms persisted for at least nineteen days after ceasing to ingest *Lamium amplexicaule*, although not so severe, and the onset was delayed when the animals were tested by driving. It is evident that the plant is more potent in producing staggers than *Malva parviflora*, at least in experimental cases, since in this instance adults as well as lambs were affected.

It is difficult to say whether the death of the lamb recorded was the direct result of staggers, since no changes could be found in the body to connect the death with the plant fed. However, a similar death occurred in a sheep being experimentally fed on mallow, and in both instances no other explanation was forthcoming than that the death was due to staggers.

A feeding experiment was attempted on a horse with *Lamium amplexicaule*, but the animal refused to eat the plant, and as time did not permit remaining in the district the experiment was not persevered with.

The Examination of Mallow for Fungi, &c.

The possibility of fungi, or other parasites growing on the plants, being responsible for the condition under consideration rather than the plants themselves, was not lost sight of. Various specimens were submitted to Dr. Darnell-Smith, Biologist of the Department, for examination in order to determine what fungi, &c., if any, were present on plants in a staggers locality, but, beyond the almost constant presence of ***Puccinia malvacearum*** on mallow of any age, nothing constant was detected, and no fungi, rusts, &c., of any known pathogenic power were reported present. In view of the wide distinction that exists between such plants as ***Malva parviflora*** and ***Lamium amplexicaule***, it appears unlikely that any fungus common to both will be found.

Conclusions.

The disease known as staggers is apparently an intoxication resulting from the ingestion of certain plants. Two, at least, have been proved to be capable of producing the condition experimentally, namely, ***Malva parviflora*** and ***Lamium amplexicaule***. The main symptoms appear to result from the intoxication of the central nervous system. No definite structural alterations have been noted histologically, and the fact that sheep removed from pastures containing plants known to cause the complaint, and fed on food other than the plants mentioned, rapidly and completely recover, indicates that no permanent damage is occasioned to nerve tissues.

It has not been definitely shown whether the toxic principle resides in the plants themselves or is due to fungi or other parasites on the plants. The former, in view of the failure to demonstrate anything of a parasitic nature save *Puccinia malvacearum* (common rust) on the mallow, is the more probable.

Although the disease is common in adult sheep under natural circumstances, yet, experimentally, on a number of occasions, only lambs showed symptoms, while the ewes remained apparently unaffected. A probable explanation of this is that adult sheep require to ingest a much larger amount of mallow in order to produce symptoms than was actually given; also that young lambs are highly susceptible to the toxin, for symptoms appeared in these animals relatively early when they were too young to eat much solid food. It is apparently probable, also, that the toxic principle is transmitted in the mother's milk without the mother showing any symptoms of staggers The results of the feeding experiments at the University (Experiment No. 4) are interesting, as, in that case, although a large total amount of mallow was eaten by the sheep, only the lambs were affected, and those only after the feeding had been carried on for some time. A possible explanation is that in the young green stage the toxin is not fixed, and is unstable at that period, and after the plant has been cut a day or more and wilted, the toxin has largely disappeared. Such toxin, however, becomes fixed as the plant matures, because, under natural circumstances, and also experimentally, the disease is produced by feeding on the dried mature plant, and even on seeds alone.

To those accustomed to seeing the small patches of mallow that grow naturally in Europe, the density of its growth in springtime and in early summer in the localities indicated in New South Wales would appear almost incredible. One may ride through acres of the plant on the rich alluvial flats, growing higher than a tall man's head, and forming a dense matted growth. In autumn this has withered away, and the ground then appears quite bare. Animals, however, thrive and grow fat on the abundant seeds of the mallow and other plants lying on the ground.

The question of the cause being a food deficiency is not discussed, because all the indications appear to point to the contrary. It has been suggested (*vide* report by J. D. Stewart, *Agricultural Gazette* of New South Wales, Vol. XI, p. 1112) that the condition was due to the high nitrogenous content of the seeds producing the toxic effects and symptoms of staggers, but this theory would appear to be untenable, both on clinical and physiological grounds. That fat sheep are held by stockowners to be most readily affected may be merely because such sheep are usually the largest feeders. Furthermore, the condition has often been seen in sheep in poor condition.

The nature of the agent responsible for the production of staggers has not yet been investigated; it would appear to be a matter for a chemist.

It is interesting to note that certain plants of two different orders, namely, *Malvaceæ* and *Labiatæ,* are able, on ingestion, to produce exactly similar trains of symptoms, although *Lamium amplexicaule* appears to produce the more potent.

Another point raised during the experiments was the question of tolerance or immunity. On certain occasions sheep fed on mallow would show all the symptoms of staggers when being tested by driving on a particular day, but on again being tested a few days later they would appear quite normal, although the diet had remained the same. This tolerance may, however, be merely an individual and not a group tolerance, for experience has shown that animals removed from a mallow country soon recover, but on being replaced on a mallow diet soon re-develop symptoms. Again, it has been shown that animals are not equally susceptible to the effects of the plants.

Effects of Mallow in the United States.

Since writing the foregoing, our attention had been drawn by Mr. W. L. Hindmarsh, B.V.Sc., to a letter in the *American Veterinary Review* (Vol. XXX, p. 106), dated 15th February, 1906, by J. H. Hester, V.S., Santa Barbara, California, headed "Injurious Effects of Malva Plant." This appears to deal with a condition identical with that studied by us. The writer inquires whether the common mallow plant of California (*Malva borealis*) is ever injurious to stock, and remarks that botanists and most stockowners scout the idea, but that observant stockmen and butchers claim that if stock are fed on it for some time, they will, if called upon to undergo any unusual exertion, suddenly develop nervous symptoms and that if such animals are urged, they will go down and probably never get up. He then relates his own experiences. During a drought a few years prior to 1906, the pastures were dried up and feed was scarce. After the rains, mallow was the first vegetation to spring up, and soon furnished almost the exclusive feed for a large portion of the stock in the locality. When the horses were put to work, it was thought that a new disease had suddenly made its appearance among them. The same condition was also seen in cattle in the same locality. In general, the symptoms were that the animals seemed quite normal when at rest, but when called upon to undergo any exertion, even such as being transferred from one pasture to another, the animals would go down.

His personal experience was concerned with a client who owned a number of horses, fed on green feed which consisted almost exclusively of mallow. One day the client drove four horses in a team to town, a distance of about three miles. On arrival, one horse was noticed to be sick. On inspection, the animal was found with head down, legs braced and all the muscles quivering. Respirations were quick and shallow. The animal was got to a stable with great difficulty. One and a half hours later the symptoms had disappeared. A few days later, apparently in another horse, a similar train of events happened, and on the resting of the animal, recovery again appeared to follow. Investigations showed that a number of animals had been similarly affected on the same farm, but if they were permitted to rest, the symptoms soon disappeared. If compelled to continue working, the animals went down and took several days to recover. In all cases where death had occurred, the animal had been urged until it collapsed. Hester diagnosed the cases as malva poisoning, and states that in each case, investigations showed that the diet had been mainly malva for some time.

No further references to this matter can be found by us and apparently the question was not taken up experimentally. There appears no doubt, however, that Hester was dealing with a condition identical with that occurring in New South Wales, called staggers.

NOTE.—The authors of the above series of articles desire to state that the references to Gunnible in the September issue of the *Agricultural Gazette*, did not refer to Gunnible station, the property of Messrs. Willsallen.

PRICKLY PEAR AS FODDER.

CONSIDERABLE success was obtained by the Bombay Agricultural Department in the use of prickly pear as fodder for cattle during the 1918-19 famine. . . . The prickly pear was roasted over a fire blown into a large flame by an ordinary blacksmith's rotary fan so as to burn off the thorns. Twelve half-starved cattle were purchased and given rations consisting of chopped up roasted prickly pear mixed at first with sorghum fodder. The sorghum was gradually reduced until the animals were doing well on a ration of 25 lb. prickly pear and 1 lb. of cotton seed per day. The latest report is that they are eating 45 lb. of the prickly pear per day and are in excellent condition.—Report of the Department of Agriculture, Madras Presidency, 1920-21.

A Kit of Carpenter's Tools.

WITH SPECIAL REFERENCE TO PLANES AND SAWS.

[Continued from page 742.]

M. H. ROBERTSON, Instructor in Carpentry, Hawkesbury Agricultural College.

The Saws.

THE saws commonly in use number four, namely, (1) the rip-saw, for cutting down the grain, No. 4 (four points to the inch); (2) the hand or panel saw, for cutting across the grain, Nos. 7, or 8 (seven or eight points to the inch); (3) the tenon-saw, for cutting tenons and shoulders and for fine work (14 inches long); and (4) the turning-saw, for cutting circles, &c.

As everyone who uses tools knows, there are such things as saws that are too stiff and those that are too limp, and to choose what one wants in these respects is not hard. A saw can be tested by taking the handle in one hand and the tip in the other and bending the tip around to the handle; if it is hard to get them to meet the saw is too stiff, but if it is too easy to bend in this way and if a buckle appears in the saw it is too limp. A saw that comes round fairly stiffly and springs back straight without leaving a buckle is the one to pick. The quality of the steel is indicated by the ring. On the whole, however, it must be admitted that there is a good deal of luck in buying tools and especially in buying saws.

Sharpening the Saw.

Before being sharpened, all saws should be run over from handle to tip with a flat file, an old mill-saw file being the best for the purpose. This is done by holding the saw by the handle, laying the file along the tips of the teeth, and running it down the tips. The effect is to bring all the teeth to a uniform height and remove any unevenness such as may have been caused by several teeth striking a nail and having the tips taken off. The rip, hand, or panel saws should have a slight belly in the centre, but a tenon-saw should be straight.

The teeth now being all of one height, we shall start to sharpen with a triangular file. This, be it admitted, is a most difficult matter for a beginner, who, if not very careful, will reduce the teeth to all shapes and sizes and leave the saw worse than it was before he touched it. The saw must be held in an upright position in a vise of some kind. The best hold of all is obtained with a pair of saw chocks or clamps (see Fig. 18), but if these are not available, an ordinary vise may be used. If the vise is an iron one, then the saw should not be gripped between the metal jaws, but between pieces of wood on either side, by which it will be found a much better hold will be obtained without damage to the saw.

Start filing at the tip of the saw, filing the back of every tooth that is leaning away from you, and the front of every tooth that is leaning towards you. As the teeth lean alternately to you and from you, this means that you use the file on each alternate tooth, leaving the other tooth to be dealt with afterwards from the other side. Most attention must be given to the filing of the tooth that is leaning away from you; it will be found in a little while that the front of the tooth leaning towards you is at the same time receiving attention, but the thing to watch is the back of each tooth that leans away.

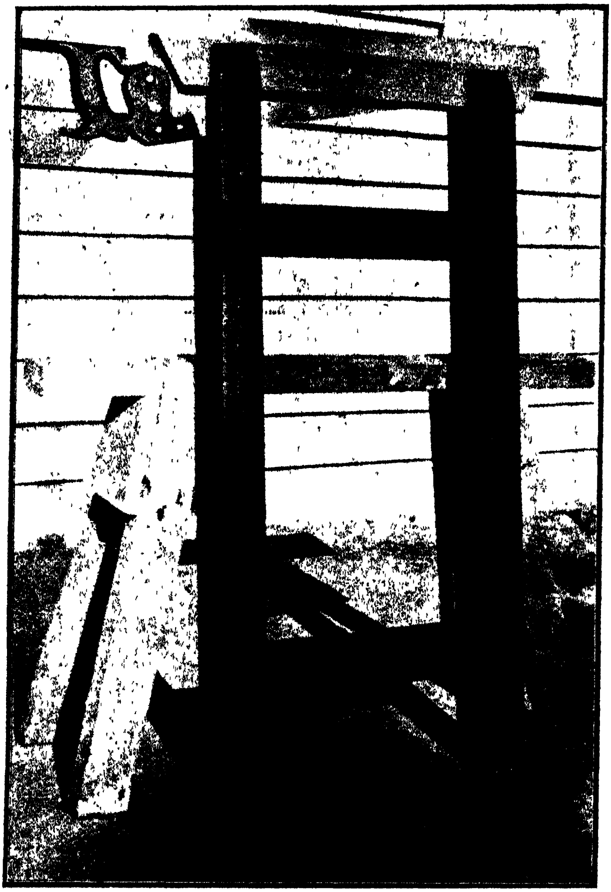

Fig. 18—A Saw Clamp.

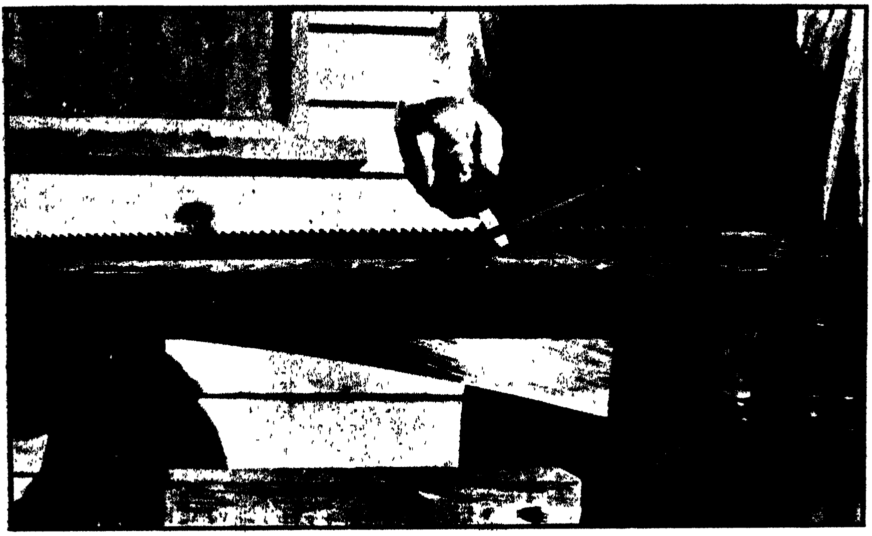

Fig. 19—The most important angle to watch while Sharpening a Saw

The angle is indicated by a flat file laid on the top side of the triangular file with which the actual sharpening is done.

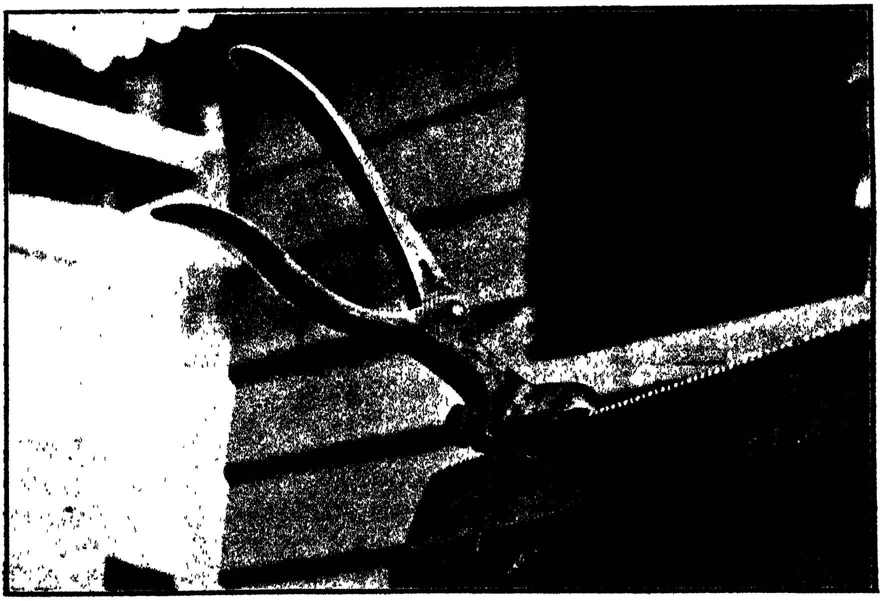

Fig. 20—An Adjustable Saw-set.

The operation is, needless to say, a delicate one and three things are essential in handling the file :—

1. The top side of the file itself must be held at exactly the same angle on every tooth. By merely altering the angle at which the triangular file is leaning a very uneven job will result. If, for instance, the top side of the file leans first at the angle shown in Fig. 19 and then at another angle, it is impossible for the job to be a satisfactory one. It is this angle that determines the amount of "hook" on each tooth, and it is most important that it be uniform. The angle indicated in Fig. 19 (the top side of the file not quite flat, but leaning slightly to the tip of the saw) will give a satisfactory "hook." This hook should be greater in the case of the rip-saw than in other types.

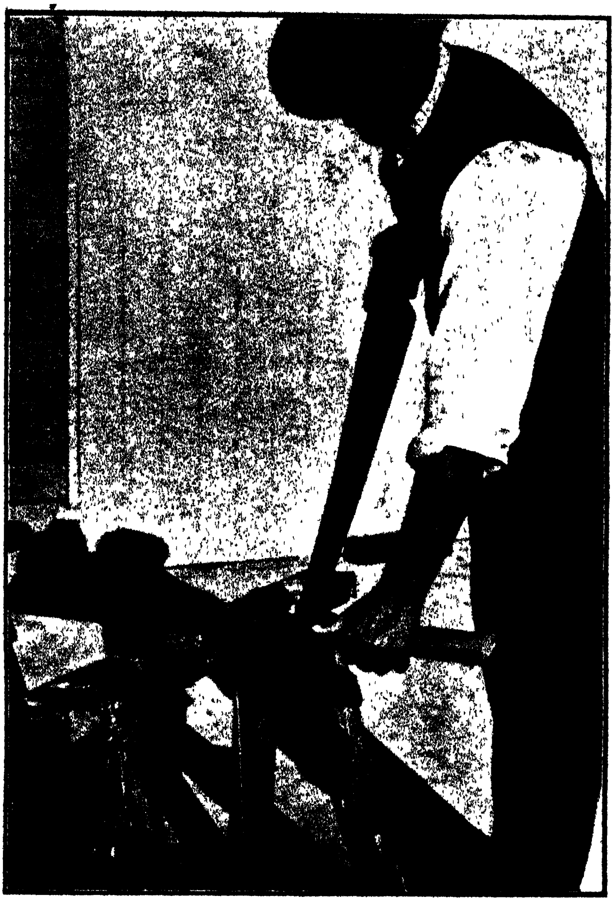

Fig. 21—The Correct Use of the Saw.
Starting the stroke.

2. The hand must be held at a uniform height throughout; it should not be held first high and then low, or an uneven set of teeth must result. Some men drop the hand and file upwards, but this is not satisfactory. The file should cross the saw at right angles to the side of the saw—in other words the point of the file should neither be elevated nor depressed, and it should be so throughout the job.

Fig. 22—The Correct Use of the Saw.
Finishing the stroke.

3. The direction at which the file is worked across the saw must also be uniform. Swinging the hand from one side to the other will be as unsatisfactory as swinging up and down. In the case of a rip-saw, the file must go straight to and fro at right angles to the length of the saw. With other saws, the handle of the file should be slightly inclined towards the tip of the saw. The effect is to form a sort of diamond point.

If the teeth are in good order and regular it is only necessary in sharpening to see that the file is pressed firmly into the angle between the teeth, but if the teeth are uneven the file must be used with a little weight on it, one way or the other, to put the teeth in order again. Where a saw is in very bad order indeed, it is sometimes necessary to run the teeth down and retooth the saw, cutting out new teeth.

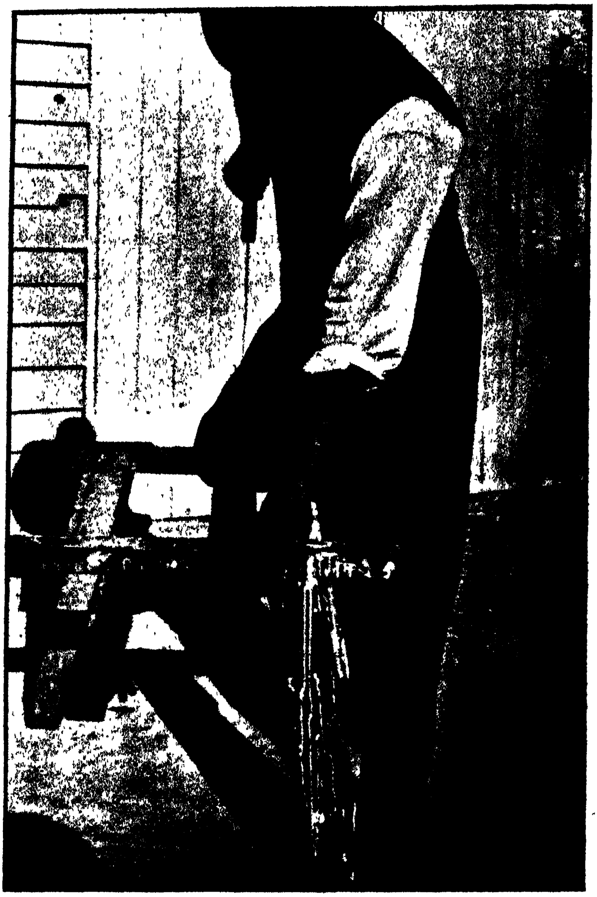

Fig. 23—The Correct Use of the Saw.

Keep the arm-pit plumb over
the saw-cut.

The alternate teeth having been treated in the way described, the remaining teeth are treated in the same way and with the same care from the other side.

Setting the Saw.

The "set" of the saw is a term employed to suggest the amount of spread that the teeth have sideways, the teeth being pointed alternately one way and then the other. Only one-third of the tooth should be bent outwards—the whole of the tooth should not have an outward lean.

With the rip-saw, very little spread is needed—sometimes none at all, but with the hand-saw (used for cutting across the grain) there should be more set, especially for green timber. When the teeth are set, there should be a distinct V or slight depression down the centre if the saw is held so that you look along the tips. The teeth must be evenly set, one side having no more spread than the other. A special "saw-set" can be obtained, which can be simply adjusted to the size of tooth and amount of spread desired (Fig. 20).

Saws must be kept away from all dampness, and may be smeared with oil at times to protect them from rust. The fumes of muriatic acid (spirits of salts) are also very destructive to them.

Handling the Saw.

Everyone can handle a saw, or thinks he can, but those who do it to the best advantage are not so numerous. In starting a cut, it is a common mistake to allow the weight of the end of the saw to rest on the timber, with the result that the teeth catch and fail to run free, the work being poorly begun. It is in the effort to avoid the catching that results from this error that so many people begin a cut by drawing the saw up to them. The right way is to start the cut with the tip of the saw (Fig. 21), striking the timber very lightly at first, and then, as the saw runs down the edge, allowing an increasing weight to come on the timber. In this way the cut is properly started in the first movement of the saw (Fig. 22). The novice, watching a cut started in this way, will remark on the ease, balance, and surety with which the tool is handled, and no doubt the secret of the successful use of all tools lies just there; but one way to acquire this command over the implement under discussion is to learn to strike correctly—to allow no weight of the saw, or hardly any, to rest on the timber at first, and to increase it slightly as the saw comes down the first time.

The position in which the operator stands is also of importance. He should stand with the saw in the right hand, leaning over his work, with the armpit in line with the cut that is to be made, so that as the saw is brought up, the handle is brought up into the armpit (Fig. 23). This brings the saw up straight in the cut. The tendency with the beginner is to draw the saw-handle towards himself as he brings his hand up, the result being that the blade not being straight, the cut is a rough one, the work is hard, and the result unsatisfactory. A long steady stroke, with a free movement, is what is required.

"Let the saw run itself," says the tradesman, and so, too, the man with a little practical experience.

Tools Suitable for Use on a Farm.

The following list of tools has been prepared as an indication of the equipment likely to be most useful on a farm. The prices quoted are a little approximate in some cases, perhaps, but in the total the variation in any retail shop of repute will be very trifling. Fluctuations in market values must, of course, be expected :—

Tools.	Prices. £	s.	d.
1 Smoothing-plane, 2¼"		17	0
1 Trying-plane, 2½"	1	7	0
1 Jack-plane, 2¼"	1	1	0
1 German Jack-plane, 1½" ...		10	6
1 Rebate-plane. 1¼"		10	3
1 Rip-saw, "Disston's," 28" ...		16	5
1 Hand-saw, "Disston's," ...		16	5
1 Tenon-saw, "Disston's," 14" ...		12	6
1 Nest of saws, "Disston's," ...		7	6
1 Saw-set		6	9
1 Oilstone		5	0
1 Rule, 2 ft.		2	1½
1 Claw-hammer, No. 5 ...		6	3
1 Square, 12"		6	0
1 Square, 6"		3	0
1 Bevel, Sliding, 10"		3	0
1 Draw-knife, 10"		5	0
1 Marking-gauge, Single		1	3
1 Mortise-gauge		5	0
1 Carriage Clamp		5	6
4 Chisels, Socket, ½", ⅝", ¾", 1" ...		12	0
6 Chisels, Firmer Socket, ⅜", ½", ⅝", ¾", 1", 1¼" ...		16	3
1 Brace, all iron, 10" ...		10	9
6 Bits, double twist, ¼", ⅜", ½", ⅝", ¾", 1"	1	1	0
11 Bits, Nail, Nos. 2 to 12, @ 6d. each		5	6
1 Screwdriver, 10"		3	6
1 Mallet		4	9
5 Augers, ½", ⅝", ¾", 1", 1¼"...	1	9	3
1 Spokeshave...		3	6
1 Adze, No. 2		9	9
6 Bradawls		3	0
1 Hatchet		5	6
1 pair Compasses, 8"... ...		3	9
1 Wood Rasp, 12"		2	3
1 Oil-can		2	9
1 Spirit-level, 24"		7	6
1 pair Pliers, 7"		3	3
1 pair Pincers, 7"		3	0
1 Metallic Tape, 66"... . .		15	9

REPUTE OF NEW SOUTH WALES BUTTER.

INFORMATION has been received by the Department of Agriculture from the United States and Canada showing the high repute in which New South Wales butter is held in those markets. These reports state that of the large quantities of butter received during the past six months from Australasia that coming from New South Wales and New Zealand was pre-eminent in quality, and any preference which existed was in favour of the former.

Reports show that importers were so impressed with the quality of the butter that they called together leading manufacturers in the States to show them what high-class competition they had to meet. The manufacturers readily realise the high standard of the Australasian products, and they have under consideration a proposal to send delegates to New South Wales and New Zealand to inquire as to the methods employed in bringing about such results.

Although New South Wales butter is better than that of any other Australian State, and at least equal to New Zealand, according to American opinion, it is sold in England as Australian at 10s. per cwt. less than the rate obtained by New Zealand exporters. New South Wales thereby loses about £6,000 per week on their export trade. Every box of butter that leaves this State is branded prominently with the words "New South Wales," in addition to the word "Australia." Therefore the identification of the State of origin is easy. The other States have not reached so high a standard of quality, consequently New South Wales manufacturers should look to it that their butter is sold on its merits, and their choicest brands should bring the same price as New Zealand butter.—*The Dairy*, London.

Picking, Grading, and Packing Bananas.

R. G. BARTLETT, Assistant Fruit Expert.

AT every centre where bananas are handled for purposes of transhipment the question of bad packing obtrudes itself. Everywhere are to be found cases that contain immature, or small or diseased, or "boiled" or otherwise damaged fruit, and everywhere, too, cases that have been packed slack or with fruit that has shrunk, leaving a space of an inch or two at the top. The influence of such lines upon the market is far more serious than many will credit, choice fruit and passably good fruit alike suffering in price in the presence of a glut of the poorer stuff.

This view—that growers are themselves often responsible for the poor prices their produce brings—is generally scouted at the producer's end. That the value of prime fruit should suffer because of an excess of poor fruit is hard to believe, yet the grower who follows up his consignment will find it is too frequently the case. In most cases the trouble lies in the fact that the grower does not see his fruit after it has been cased and despatched from the plantation, and therefore has no knowledge of the depreciation that takes place as a result of his faults in packing, and of the damage that may be done during transport to fruit that at the start was perhaps, "not so bad.' It is perfectly true that poor prices are often the result of other conditions, but before there can be permanent improvement it has to be recognised that often poor packing is a substantial factor.

For the successful marketing of bananas, the first thing is to pick the fruit at the proper stage, viz., when there are no "corners" and nothing of the "French bean" character—in other words not long and thin. Mature, well filled fruit only should be picked, and it should be handled with the greatest of care at every stage.

The bunches should be cut early in the morning or late in the afternoon, but not in the heat of the day, and should be immediately removed to the shade. An hour's exposure to the sun, especially in the summer, will do more harm than most growers realise, the more so as the damage done does not show up until after the consignment has been sent away. The bunches should be placed on the shady side of the tree and covered with trash, and if they have to lie there long enough for the shadow to shift and no longer protect them, they should be moved so as to be still in the shade. The point is of far greater importance than many growers realise. As showing the effects of the rays of the sun, the case may be mentioned of one grower who stacked his fruit where the sun shone through a window in the packing shed, falling on part of the stack of full cases. It took him a while to realise that that stray patch of sunlight accounted for a portion of his consignments reaching the market in a depreciated condition.

So important is this matter of exposure to the sun that, as remarked further down, growers should give attention to it when the cases are stacked on the roadside to await the carter.

It is always wise to allow the fruit to stand on the bunches for, say, twelve hours, in order that some of the moisture may escape, and the bananas become less brittle and liable to marking.

"Handing off"—separating the hands from the stalk—should take place twelve hours before packing, so that an interval of at least twenty-four hours shall elapse between the cutting of the bunch and the final packing of the fruit. Care should be taken in cutting the hands off the bunch that as much stem as possible is left on the fingers. This prevents stem-end blackening, and ensures a better flavour in the fruit. As every grower knows, the bananas are better when ripened on the bunch, and when plenty of stalk is left on each hand.

There is not a single grower probably who does not know that no diseased or damaged fruit should be sent to market, but quite a lot of the kind nevertheless reaches Sydney as a result of a desire to forward everything that is likely to turn to money. If those who are guilty of these practices would only put themselves in the place of the consumer they would quickly realise how they inevitably spoil the demand; no one will run the risk of buying diseased or immature fruit a second time.

Attention may be called to the danger of what are known as "boiled bananas." During the months of January and February many growers have only themselves to blame for their produce showing this character. They think that immature fruit is not so subject to the trouble as the more mature. As a matter of fact the fuller the fruit the more fitted they are for sending away, and the greater the chance of reaching their destination in good condition, allowing, of course, for other adverse circumstances.

Immature bananas should never be sent away at all. Not only do they not carry well, but they do not ripen properly, only colouring and softening on the outside, but having a hard centre core.

Lining the cases with paper can hardly be overvalued, as it prevents undue rubbing of the easily-bruised skins against the sides of the cases. Paper is a non-conductor of heat, and in the summer the paper should be broken along the sides to allow of the ventilation of the cases. In fact, in January and February the paper along the sides may be omitted altogether, only the tops and bottoms being lined.

In packing, the hands should be broken into three's and four's, and spaces in the cases should be filled in with singles. On a good bottom layer very largely depends the ultimate result of the whole "pack." On no account should spaces be filled with smaller fruit than the average of the case, as that spoils the grade. The case should contain fruit of only one size.

In order to allow for shrinkage in transit, the case should be packed an inch to an inch and a half above the top, the contents curving upward from the ends so as to be highest at the centre. Nailing down can then be done without the fruit at the ends being bruised.

One end of the case should be raised a couple of inches off the floor, in order to allow of the slight bulge on the bottom. If the tilt of the case is toward the operator it will be found that the fruit will pack tighter, falling toward the packer. Growers are strongly urged to make or obtain a simple press for nailing down the lids, and to abandon the pernicious practice still followed of severely bumping the fruit down.

As long as growers pack an even size of fruit in each case there should be no necessity to brand the cases "choice" and "extra choice," for the buyer is the keenest grader. Every grower brands his own best as "extra choice," without regard for any specific standard meaning that might attach to the term.

Once more must attention be called to the need for sheltering the fruit while it is waiting on the roadside for transport. Sometimes a consignment is allowed to remain for a whole day in the sun, not only to its own serious damage but to the detriment of other fruit with which it comes in contact, whether in trucks or on board ship. Suitable bush shelters can be erected very inexpensively, and there is no reason why several growers should not combine to erect one for their common use. The small outlay in the way of labour will be amply repaid, especially where the produce is, in other respects, being well graded and handled.

Under no circumstances should cases be stood on their ends or on the bulge during transit, as damage is certain to result. They should always lie on the flat sides. In this respect, of course, it is impossible to follow the consignment through its many handlings, but the effect of continual care and of correct handling at the grower's end, together with a steady cultivation of the idea that the fruit is a delicate product that requires proper handling, will ultimately ensure that the product reaches the consumer in prime condition.

If associated with all this there is the steady regard for the grower's own good name and the honesty of his pack a reputation can be gradually built up that will enable the best prices to be obtained at all times.

THE MARKET FOR PASSION FRUIT PULP

PASSION fruit pulp is a commodity for which there seems to be a growing demand, both in America and London. A considerable quantity of pulp was sent to America last year—about £10,000 worth. This was forwarded in wooden casks, a certain proportion of sugar being added and the whole shipped at a low temperature direct. The price paid by the purchaser, it is understood, varied according to the quality from 1s. 3d. to 9d. per pound, and as 2½ lb. of passion fruit will make a pint of pulp the prices may be considered satisfactory.

This Department has carried out a considerable amount of work in connection with the best method of putting up the pulp, the method favoured being to pulp in cans and subject these to a heating process. It has been ascertained that to bring the pulp to a temperature of 190 degrees Fah. in a period of twenty minutes results in a very excellent article; but there is every reason to believe that the temperature can be reduced without any lengthening of the time, and further investigations under this and other headings are at present in progress.—S. A. HOGG, Assistant Fruit Expert.

Pure Seed.

GROWERS RECOMMENDED BY THE DEPARTMENT.

THE Department of Agriculture publishes monthly in the *Agricultural Gazette* a list of growers of pure seed of good quality of various crops, in order to encourage those who have been devoting attention to this sphere of work, and to enable farmers to get into direct touch with reliable sources of supply of such seeds.

Intending purchasers are advised to communicate direct with growers regarding the prices for the seeds mentioned hereunder.

Wheat :—

Bomen	Manager, Experiment Farm, Temora.
Canberra	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
Clarendon	Manager, Experiment Farm, Glen Innes.
	Manager, Experiment Farm, Coonamble.
Federation	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Temora.
Florence	Manager, Experiment Farm, Coonamble.
	Manager, Experiment Farm, Glen Innes.
Gresley	Manager, Experiment Farm, Temora.
Hamel	Manager, Experiment Farm, Temora.
Hard Federation	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Temora.
Marshall's No. 3	Manager, Wagga Experiment Farm, Bomen.
Sunset	Manager, Experiment Farm, Coonamble.
Warden	Manager, Experiment Farm, Cowra.
	Manager, Wagga Experiment Farm, Bomen.
Yandilla King	Manager, Wagga Experiment Farm, Bomen.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.

Oats : —

Algerian	Manager, Experiment Farm, Bathurst.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.
	Manager, Experiment Farm, Glen Innes.
Guyra	Manager, Experiment Farm, Glen Innes.
Lachlan	Manager, Experiment Farm, Cowra.
Mulga	Manager, Experiment Farm, Glen Innes.
	Manager. Experiment Farm, Cowra.
Sunrise	Manager, Experiment Farm, Coonamble.
	Manager, Experiment Farm, Temora.
	Manager, Experiment Farm, Cowra.

Grasses : —

Paspalum dilatatum	Manager, Experiment Farm, Lismore.
Elephant	Manager, Experiment Farm, Grafton.
	Manager, Experiment Farm, Lismore.
	Principal, H. A. College, Richmond.
	Manager, Experiment Farm, Cowra.
Kikuyu	Principal, H. A. College, Richmond.
	Manager, Experiment Farm, Lismore.
	Manager, Experiment Farm, Grafton.
Sudan	Manager, Experiment Form, Cowra.

A number of crops were inspected and passed, but samples of the seed harvested have not been received, and these crops have not been listed.

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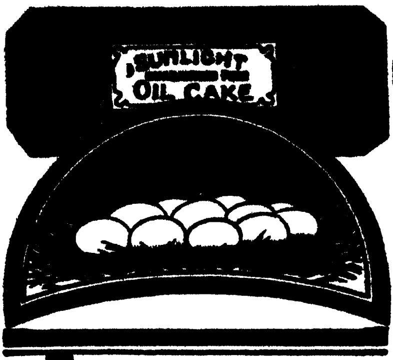

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Poultry Notes.

DECEMBER.

JAMES HADLINGTON, Poultry Expert

POULTRY-FARMING, in common with most primary industries, is subject to seasonal fluctuations in relation to returns; with the difference in favour of the poultry-farmer that he has regular seasonal expectations of production from his hens, and these do not vary materially, with the same denominations of stock, from year to year. It has been indicated in these notes what these expectations are from month to month. In any business such a knowledge would be regarded as an important factor, and of great value as a guide to the person conducting it. Most other primary industries are governed by weather conditions to a much larger extent than is poultry farming as far as production is concerned, but the industry is nevertheless very largely affected by the nature of the season, at any rate as far as it affects the production (and therefore the prices) of wheat and maize, and also the milling of flour, and therefore the prices of pollard and bran. Dry seasons also affect the poultry industry by "mopping up" supplies of pollard and bran, as dairy farmers fall back heavily upon these commodities.

Seasonal Expectations.

It might be profitable and instructive at this time of year to review the economic factors in connection with poultry-farming. For instance, one seasonal expectation is that after the pinnacle of egg-production has been reached (usually about the end of October) November will bring a drop. December is expected to be a shade lower and so on until May, when the bottom is reached. Each succeeding month will usually bring a hardening of prices, though not necessarily in proportion to the fall in production. Although the balance on a well run farm is often fairly well maintained by production from pullets until about March, at that point the higher prices do not anything like compensate for the very much reduced production, and the poultry-farmer is compelled to fall back upon cash reserves or upon his credit to tide him over the slack period.

While all this is true there are still means by which the poultry-farmer can by good management and forethought—or in other words, by energy, ability, and business acumen—help himself so effectually that the slack season of production holds no terrors for him. It is a case of forewarned being forearmed—the expectation is one that recurs annually and one must prepare to meet it. It is not a question whether poultry-farming will pay over any particular period of the year, but (*a*) the average production per hen per annum; (*b*) the average price of eggs over the whole year; and (*c*) the average price of foodstuffs over the same period. No other way of assessing the paying nature of poultry-farming is of any value or significance, and these being the factors it will be seen that despite all the vicissitudes through which poultry-farming has passed in recent years, the averages obtained show poultry-farming to have paid on the whole quite as well as during any period in the writer's long experience.

Success Depends on Management.

In the first place nobody should take up poultry-farming who does not love the work and who is not prepared for a life of concentration upon his farm. Poultry-farmers as a class are probably the most independent of men, but it is at the cost of close attention to their business, and their measure of success (as in most other undertakings) is in proportion to the energy, ability and capital that has been put into their farms. Lack of any one of these is a handicap.

Let us take as an instance the pullets of the season's rearing. Whether or not they will come on to lay and continue to do so within reasonable limits of expectation depends more upon management than almost anything else. Many poultry-farmers who have entered the business in recent years have yet to learn that a fair modicum of success does not depend so much upon the super egg-production attained in competitions, but rather on a recognition of the fact that the well known and established capacity for production of the popular breeds will ensure profitable production if the birds are well managed. Nor can any hereditary tendency to super-production be developed under indifferent management. The inclination to stress hereditary tendency and to neglect the importance of good management has been the cause of a good deal of disappointment on the score of poor production.

Treatment of Pullets.

As an illustration of this we might take White Leghorn pullets—probably the most "tricky" breed we have in regard to performance as pullets during the late summer and autumn. Just when it is expected that they are settling down to lay they often fall into a moult. To some extent this is inevitable and to be expected, but the extent to which this is due to bad management is not always recognised. A few hints on the management of pullets during the period referred to will, therefore, perhaps be of timely service.

Early pullets should not be forced or they are liable to fall to pieces. They should be fed rationally, and in accordance with the Department's recommendations on feeding, and the feed should not be changed. Early pullets, rationally treated, should come on to lay about December or January.

The next thing is to keep them laying. As mentioned in last month's notes, one of the causes of pullets breaking up is housing in too large numbers, and the trouble brought about in this way occurs in spite of the size of the house. For instance, no matter if a house will accommodate 1,000 pullets, it is a big mistake to put even 100 in it unless it is divided into compartments. What happens where large numbers of pullets are put together is that they pack up close together at roosting time, and once packed on the roosts they will not spread out, the end occupants of the perches refusing to move. In the event of a hot night the pullets become sweated through being packed so close together—an occurrence that is most likely to cause them to stop laying, and once a pullet stops laying during the months referred to she invariably goes into moult. This as a rule means six weeks off laying, and if cold weather should supervene she will not probably come on again for some considerable time.

The following points should be observed:—

1. House in small numbers, not more than 50.
2. Do not change the food once the pullets have come on to lay.
3. Feed full and plenty at all times.
4. Do not get the idea that the pullets (or hens for that matter) may get too fat.

The last is one of the most frequent causes of poor production, and sometimes of failure to produce. The birds should be fed full and plenty at all times, though, of course, they should not be surfeited with food by allowing it to lie about the yards all day or at night. Few realise to what extent production is dependent upon skilful feeding.

This, of course, raises the question: What about dry feeding where the hoppers full of food are before the bird at all times? The reply is that dry food is not sufficiently appetising to induce the birds to eat to the point of surfeit. It is not intended, however, to enlarge upon the merits or demerits of the different systems. In the case of adult stock the question might be left to the individual. On the other hand, dry feeding of mash to chickens or growing stock is not recommended.

Protect Pullets from Chicken Pox.

A reminder is seasonable that the protective measures against chicken pox should be commenced early next month.

A tablespoonful of flowers of sulphur for the equivalent of every fifty adult birds should be given in the morning mash every third day for a period of three weeks. Then this should be stopped, and for the next three weeks Epsom salts should be added every third day to the drinking water at the rate of one ounce to the gallon. At the end of the three weeks stop the Epsom salts and return to the flowers of sulphur in the mash, and continue alternating the treatment until the period is passed over which chicken pox is seasonable.

It is emphasised that the full protective benefit of the flowers of sulphur will not be obtained unless the advice given is carried out in its entirety and to the letter, but in order that no misunderstanding may arise it may be stated in terms of weight for weight. To every 7 or 8 lb. of the mash, whether wet or dry, one ounce of sulphur should be mixed, commencing well ahead of the time when the disease is liable to appear, and continuing till the season is over, which means that it is advisable to commence the sulphur treatment in this State in the first week in January and to continue it through the summer till about April.

"THE PRESERVATION OF FOOD BY FREEZING."

PROFESSOR Walter Stiles has, at the request of the Food Investigation Board, England, prepared a report upon the preservation of food by freezing.*

Practically there are only two methods employed in the freezing of food on a large scale. These involve freezing in cold air and in cold brine respectively. Professor Stiles does not deal with the economic side of the refrigeration industry, The scientific side, however, as regards beef, is for us a matter of interest.

For the refrigeration of meat, freezing by immersion in brine has not yet been technically employed; the only process used is that of freezing in cold air. Beef which has been preserved in the frozen state is frequently inferior to fresh beef, on account of the drip of meat juice which occurs on thawing. This loss may amount to as much as 15 per cent. of the weight of the meat. Consequently beef is, wherever possible, transported in the chilled condition, but since it cannot be kept in this state for more than three or four weeks, it is not possible to export chilled beef into the United Kingdom from Australia and New Zealand. From far distant countries beef must go "on the hoof," or in the frozen condition. Mutton, on the other hand, can be exported in the frozen state from the countries named in perfectly satisfactory condition.

The discovery of a method of freezing beef which will obviate the difficulties mentioned is evidently a matter of importance, and the attempts made by the Food Investigation Board in this direction are of considerable interest. Small preliminary experiments indicated that rapid freezing by immersion in cold brine was an effective way of preservation so far as the absence of drip and the appearance and flavour of the product after thawing were concerned Large scale experiments have not yet gone sufficiently far to yield conclusive results. One rather serious objection is the discolouration of the surface layers of the lean of the meat owing to the conversion of the red colouring matter of the blood into a body of slightly different chemical composition. The discolouration detracts seriously from the appearance and market value of the meat, but it is hoped that the cause and a method of prevention will be discovered in the course of further work. The successful application to beef of the method of brine freezing would lead to a very desirable expansion in the facilities for beef export.—G. P. DARNELL-SMITH.

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* The Preservation of Food by Freezing, with special reference to Fish and Meat," by Walter Stiles, Special Report (No 7) of the Food Investigation Board, published by H.M. Stationery Office, London, 1922.

TOP-DRESSING TRIALS AT GLEN INNES.

THE results of pasture top-dressing trials at Glen Innes Experiment Farm during the season 1921 22 were slightly in favour of a mixture of sulphate of potash and superphosphate, at the rate of 75 lb. of each per acre, as compared with a complete manure consisting of 150 lb. nitrate of soda, 75 lb. sulphate of potash, and 75 lb. superphosphate, and another mixture consisting of 150 lb. nitrate of soda, and 75 lb. superphosphate. All the top-dressed plots gave considerable increase over the unmanured section. The experiments are being continued.—J. N. WHITTET, Agrostologist.

Organisation in the Fruit Industry.

W. J. ALLEN.

It is often asked why fruit-growers (who should be alive to the advantages arising from any well-directed scheme of co-operative organisation) have not, up to the present, given the subject more serious consideration.

It may be that they have felt secure in their individual efforts so long as they produce good quality fruit, knowing that when honestly graded and properly packed it has generally commanded remunerative prices on the Sydney market. It must be remembered that fruit-growers are not in a similar position to dairy-farmers. The latter have to send a large portion of their output to factories where it is converted into butter or cheese, and from those factories co-operative effort has been stimulated amongst them, whereas growers of fruit, other than for canning and drying, have been able to grow, pack, and send their fruit to some central market where, as previously mentioned, satisfactory prices have generally been obtained for fruit of good quality. This happy state of affairs, however, is fast disappearing, for production now is almost equal to the demand, and growers will have to look to overseas markets if they are to dispose of their surplus crops of fresh, dried, and canned fruits.

The time is at hand when we must seriously consider the exploitation of oversea markets, and it is becoming increasingly necessary to organise the different sections of the fruit industry, in order that uniform standards may be adopted throughout Australia which will be representative of our different dried, canned, and fresh fruits, so that when our goods reach their destination buyers will always find them up to the standard of the samples previously submitted.

To achieve this objective we shall have to organise in such a manner that the whole of Australia will be living up to a standard of quality as high as that of its competitors. We must see that our standard, for the export trade at any rate, is sufficiently high and we must allow nothing below that standard to leave our shores. Individual growers cannot hope to keep to this straight and narrow path without some organisation through which they may be able to keep in touch with the requirements of the local as well as the overseas trades, and in this way they would reap the advantages which usually result when combined effort is made to reach an objective.

One of the best and strongest of the co-operative organisations in Australia is the Australian Dried Fruits Association, which has done yeoman service for its industry and has made it possible for a good living to be made from a 12 to 20-acre block of land in the central and western districts of the State, provided, of course, it is suitable for growing drying varieties of fruit. Many growers of dried fruits hardly realise what this Association has done for their industry, and one shudders to think what would happen to the dried fruit trade if ever the Association should cease to exist.

During the past year or two there has come into existence a desire on the part of citrus-growers to organise and use a standard case for export, and to have standard grades and packs for their fruit. Central packing houses have been established, and this year fruit from these houses has been placed on the best markets of the world, including London, New York, Montreal, Vancouver, and New Zealand, and some fruit has found its way to the East. These organisations may be justly proud of their efforts and success in this connection, but there is still much to be done in exploiting the markets of the world, and we should not be satisfied until our fruit is found wherever there is a demand for it.

Then there is a banana-growers' organisation which has done good work for the grower. The association looks after the trucking and despatching of many thousands of cases of bananas monthly on behalf of its members, a small levy being made on each case, and through it members may purchase practically all their requirements. It has supplied growers with many thousands of good, healthy banana suckers for planting, and with cases for the fruit, and it has relieved growers of many worries to which they would otherwise have to attend themselves. It will be seen that many in the banana industry are already enjoying the benefits of co-operation.

The day is surely coming when all fruit-growers will of necessity give the co-operative movement their whole-hearted support, for without such an organisation it will be next to impossible to set up uniform grades, &c., for our products, and without them it will be difficult to maintain a good name for the many commodities that before long will have to find outside markets.

Fruit is a much more perishable commodity than butter, and there are many kinds, all requiring separate organisations. To find markets for dried, fresh, and canned fruits abroad will require the services of well-trained business men, not only capable salesmen but effective advertising campaigners. They will have to carry stocks of dried and canned fruits, and arrange for cool storage space where fresh fruits may be held until they are cleared. To do all this requires money. Fruit-growers of other countries have organised in such a manner as to be able to raise funds for such propaganda and educational work in foreign countries. The all important question is—can we?

TEXAN MEALY BUG AND PRICKLY PEAR.

AT Scone a clump of prickly pear (*Opuntia inermis*) has been artificially infested with the Texan Mealy Bug (*Dactylopius tomentosus*). This clump was enclosed under a cheese-cloth screen, 8-feet high, and the mealy bug protected from outside influences and insect enemies until it had thoroughly spread and covered all the foliage of the enclosed pear. Midway through June the screen was removed and the infested leaves cut, carried all over the paddock, and skewered on to healthy plants. The action of the bug under cover had not been very deadly, but now that the distribution has been made we should be able to judge, after the summer is over, if this insect has any value as a natural enemy of prickly pear.—W. W. FROGGATT, Government Entomologist.

December Work in the Apiary.

W. A. GOODACRE, Senior Apiary Inspector.

IN some localities extracting work is now being carried out rather extensively; in others very little honey is being stored by the bees. The season is somewhat patchy, as might be expected after one so generally good as the last, but there should nevertheless be a fair quantity of new honey available for market. As a fair surplus is held over from last season, and good crops are expected in other States, bee-farmers should be particularly keen on the marketing question right from the beginning. They should see that country centres are well catered for, and thus prevent as far as possible a glut on the city market. I would again urge that bee farmers give their support to those who are endeavouring to secure a good system of co-operative marketing.

Hive Accommodation.

With the season now well advanced, the trouble from swarming will be lessened. The procedure of providing ample accommodation in the hives should nevertheless be continued. Many bee-farmers lose a good deal of honey during progressive times by not giving sufficient consideration to the provision of ample storage room. It is quite a common practice to use small hives, having only one full-depth or two smaller supers above the brood chamber, the apiarist allowing this to be filled and the honey sealed without making any extension of the hive. As a consequence the bees probably fill the combs with new honey in a week, and then idle for another week or so in ripening and sealing it. The apiarist acquainted with his business will add an extra super when the first super is nearly full of unsealed stores, so that the bees can still go on storing while the ripening process is being carried out. Sometimes during progressive periods the bees will fill two full-depth supers, and it is necessary to add a third in order to prevent loss while the ripening and sealing process is being sufficiently advanced for extracting work.

There are a few bee-farmers who extract unsealed honey and afterwards ripen it by artificial methods, but the beginner should not attempt such an operation. Even to the practical man it is not recommended. It is preferable for the hives to be built up, and the bees allowed to finish the work of ripening and sealing.

Increase of the Colony.

While it is preferable to go in for increase earlier in the season, December and January are not too late for the work, providing conditions and prospects are favourable. The idea of making increase early in the season is to get the colonies built up in time to obtain some surplus from them When increase is made later, the most that one can expect is to get an autumn extraction from the new colonies, or have them built up to go into winter in good condition. When forming nuclei at this period more bees and brood should be given.

Ventilation of the Hive.

The method advised for hive ventilation was described in the July issue of the *Gazette.* Particular attention to this matter is now necessary, for the bees suffer considerably, and losses may occur, when the ventilation is insufficient. In hot weather the combs, heavy with honey, may fall and destroy a large number of bees.

When forming nuclei many apiarists block up the hive entrance with grass. This is a risky procedure, however, during hot weather, and reports are continually coming to hand of colonies, that as a result of it, have been smothered. The use of strips of wire cloth pressed into the entrance is a better plan. If the nuclei are fairly numerous additional ventilation may be given by inserting a thin wedge under the cover, the wedges being removed when the bees are liberated.

Brood Disease.

If during progressive times every bee-keeper were to make a special examination of the hives early in the season for the purpose of detecting brood disease, immediately treating such cases as he may discover, much more effective work would be done toward eradication. Brood should be examined for suspicious signs such as discoloured and perforated capping. If in suspected cells are found dead, coffee-coloured larvæ which will "string out" when picked at with a match, stalk or twig it is pretty sure brood disease is present. Laboratory tests are carried out by the Department, and bee-keepers who suspect that brood disease is present in their hives, but who are not certain, should forward a specimen of suspected brood for examination, meantime preventing any robbing from the hive by blocking up all cracks and reducing the entrance.

FOR WORMS IN FOWLS.

"WHILE cleaning cockerels for table use recently," wrote a correspondent, "I discovered worms in the intestines. I should be glad if you would recommend a remedy and preventive measures."

There is considerable difficulty in administering worm medicine to flocks. Individual birds might be treated by giving a mixture of oil of turps and salad oil in equal quantities in a bit of pollard or bread, at the rate of 10 drops of the mixture to each bird; or 7 grains of powdered areca nut may be given in the same way. The medicine should be administered while the birds are fasting, and they should be fasted for three hours after, and then given a teaspoonful of Epsom salts before food.

In chickens that have been well reared worms should not be found in sufficient quantity to do harm. Prevention should be the prime aim. Common salt, given regularly in the morning mash, will be found potent in preventing infestation. About one ounce to every 5 lb. of morning mash will be sufficient.—JAMES HADLINGTON, Poultry Expert.

Vineyard Notes for December.

H. L. MANUEL, Viticultural Expert.

WITH conditions such as those experienced during this spring up to the time of writing, it behoves every grower to conserve as much soil moisture as possible, and to attain this, thorough cultivation is essential If it should happen that the summer rainfall is also limited, the vines grown in the drier districts will feel the effects, and will show the results in the diminished yield before the season is through. Good deep cultivation is what is necessary. Surface scratching is not worth the labour expended on it.

Spraying.

Although weather conditions have been very dry in most parts of the State to date, it is unwise to neglect or put off spraying with Bordeaux until rainy conditions set in. A thorough coating on the vines beforehand will serve as a protection against an attack of Downy Mildew, and, as has been said on numerous occasions, "risk is inadvisable with this disease."

Buds and Grafts.

Where young stock shoots make there appearance on young vines that were budded last autumn, and on others grafted in the spring, they should be removed from time to time. In the handling of the grafted vines care should be taken not to expose the young and tender scion growth suddenly to the heat of the sun. In opening up the soil mound to remove stock shoots it is advisable to replace a light covering of soil over the small scion shoot, allowing it to work its way through and harden off gradually. Sudden exposure to the hot sun's rays will result in a burning off.

Some of the Yema buds may have been found to be backward in shooting. The irregular bursting of the buds can be accounted for by the dryness of the season, but once the bud bursts, it will be found that it will make rapid headway, and will outpace an ordinary growing shoot. It is very necessary to support the scion shoot by means of a stake, or by tying to a trellis wire, as winds are always liable to break the growth out at the union.

BIOLOGICAL WORK FOR THE APIARIST.

A CERTAIN amount of attention has been devoted to the investigation of bee diseases during the year, diagnoses of foul brood have been made, and *Nosema* disease has again been encountered and observations on its incidence recorded. A search for the mite causing Isle of Wight disease has been unsuccessful. It seems very unlikely that this disease has ever yet entered Australia. The Federal Government has wisely prohibited the importation of queens and bees from the United Kingdom.—G. P. DARNELL-SMITH, Biologist, in a recent report.

Orchard Notes.

DECEMBER.

W. J. ALLEN and W. LE GAY BRERETON.

THE majority of districts are experiencing a dry time, and those orchards which were ploughed early, and have since been cultivated, are showing to distinct advantage over those where the ploughing was delayed till spring.

One meets cases where ploughing and horse cultivation have been faithfully carried out, but where a crop of weeds has been allowed to grow directly around the trees, such growers should realise that the weeds are a heavy drain on the soil moisture and definitely check the trees, especially young trees. Though during dry seasons the land can be kept in good order with fewer cultivations and chippings, it is well to remember that the fight is not over. When showers fall the surface crust should again be broken to form a mulch, which will not only prevent the moisture from recent showers from drying out, but also conserve the moisture that has fallen in previous rains. A dry season is also a good opportunity to attack persistent weeds, such as couch and sorrell.

Pests and Diseases.

A watch should be kept for the first small codlin grubs entering the fruit, and in orchards where this pest has been particularly bad in previous seasons, an endeavour should be made to search systematically through the trees for any attacked apples or pears, collecting such fruit in a bag or apron hanging from the shoulder, and destroying them by burning or boiling. In this way the grubs are caught and destroyed before they leave the young fruit. Though expensive, it is one of the best ways of completing the work of cleaning up a badly infected orchard.

The earlier setting varieties of apples and pears will now be ready for their third application of lead arsenate. Soap, up to 1 lb. to 10 gallons of spray, can be added as a spreader, provided lime-sulphur, Bordeaux mixture, and atomic sulphur are not also combined, and provided also that the soap is first diluted with some of the mixing water and then added by being stirred in just before the spray is applied. Care must be taken that the right amounts of both lead arsenate and soap to the total quantity of liquid are preserved. The combination should not be kept even over dinner time, as the alkali in the soap acts on the lead arsenate and converts a certain proportion into water soluble forms of arsenic. The soap added to the lead arsenate also assists in keeping woolly aphis in check. To make this still more effective in regard to woolly aphis add a concentrated nicotine extract; when soap is used the quantity of nicotine extract can be reduced to some extent, ¾ pint being used in place of 1 pint to 100 gallons of spray.

Owing to the weather conditions it is not likely that fungicides for Black Spot of apple and pear will be needed at this stage. But Powdery Mildew of the apple is often quite troublesome in dry seasons, and in such cases colloidal, atomic, or atomised sulphur can be used with the lead arsenate, provided the soap spreader is not used.

Though by the end of the month grape vines will have passed the risk of attacks of Black Spot, no chance should be taken with Downy Mildew, as there is still plenty of time for an outbreak from this disease should the right weather conditions occur.

A watch should be kept for the cherry tree slug, and arsenate of lead spray should be applied as soon as the trees are cleared of their crop if it should appear near to picking time.

Summer Training.

The young trees will require watching, and any young leaders that are outgrowing their neighbours, or any unnecessarily strong shoots, should be checked, as described in previous issues.

Citrus trees can still be pruned. Where, in older orange and mandarin trees, the wall of foliage is extending outwards some of the inside growth will be found to be perishing and can be removed.

Fruit Drying and Preserving.

The apricot is the earliest fruit that is dried commercially, and work will start at the end of this month. Fruit for drying should be fully ripe. Full directions for this work will be found in Farmer's Bulletin, No. 52, "Fruit Drying," which may be obtained from the Government Printer, Sydney, price 10d., post free.

Another useful publication on a related subject is Farmer's Bulletin, No. 88, "Fruit Preserving: Canning, Boiling, Jam-making, &c.," price 10d. post free from the same address.

BREAD AS FOOD FOR POULTRY.

"I HAVE been offered a quantity of stale bread in regular supply, but I am doubtful of its food value in relation to fowls. I have a large number of young cockerels, which I intend to market about Christmas time, and thought that the bread would be a cheaper means of feeding them, even if it were not suitable for pullets or laying hens. I can get the bread at the rate of 2s. per eighteen loaves, which equals 36 lb., so that, providing it is a suitable substitute or partial substitute for bran or pollard, it would mean a considerable saving in the food bill."

The writer of the forgoing communication was informed by the Poultry Expert that the nutritive value of bread is approximately 61½, the albumenoid ratio 1 to 7, and the moisture content approximately 38 per cent. On these figures bread at 2s. per 36 lb. would constitute a dearer food than pollard and bran. If bread is used at all in the feeding of poultry it should first be soaked, and then dried off with pollard.

AGRICULTURAL SOCIETIES' SHOWS.

Secretaries are invited to forward for insertion in this page dates of their forthcoming shows; these should reach the Editor, Department of Agriculture, Sydney, not later than the 21st of the month previous to issue. Alteration of dates should be notified at once.

1923.

St. Ives A. and H. Association	A. K. Bowden	Jan. 12, 13
Kiama Agricultural Society	G. A. Somerville	,, 25, 26
West Bargo A. H. and I. Society	L. J. C. Hicks	,, 26
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Wollongong A. H. and I. Association	W. J. Cochrane	Feb. 1, 2, 3
Inverell P. and A. Association	A. L. Varley	,, 6, 7, 8
Central Cumberland A. & H. Association (Castle Hill)	H. A. Best	,, 9, 10
Tahmoor and Couridjan	E. S. Key	,, 9, 10
Yanco A. Society (Leeton)	W. M. Evans	,, 13, 14
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Guyra P. A. and H. Association	P. N. Stevenson	,, 20, 21, 22
Nepean District A. H. and I. Society (Penrith)	C. H. Fulton	,, 22, 23, 24
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Kangaroo Valley A. and H. Association	L. W. Vance	,, 23, 24
Newcastle A. H. and I. Association	E. J. Dann	,, 27, 28,
Southern New England P. and A. Association (Uralla)	C. T. Griffin	Feb. 27, 28, Mar 1
Dorrigo and Guy Fawkes A. Association	A. C. Newman	,, 28, Mar. 1
Robertson A. and H. Society	E. S. Martin	,, 28, Mar. 1
Alstonville Agricultural Society	W. J. Dunnet	,, 28, ,, 1
Moruya A. and P. Society	H. P. Jeffery	,, 28, ,, 1
Griffith A. Society	M. E. Sellin	,, 28, ,, 1
Braidwood P. A. and H. Association	R. L. Irwin	,, 28, ,, 1
Oberon A. H. and P. Association	C. S. Chudleigh	Mar. 1, 2
Luddenham A. and H. Society	L. W. Eaton	,, 2, 3
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Orange A. and P. Association	G. L. Williams	,, 6, 7, 8
Manning River A. and H. Association (Taree)	R. Plummer	,, 6, 7, 8
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